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THE NEW NATURAL HISTORY

By

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and

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With Introductions by

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AND

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Illustrated with

SEVENTY-TWO COLORED PLATES AND TWENTY-ONE HUNDRED ENGRAVINGS

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TO VIND
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INTRODUCTION

BY

ERNEST SETON-THOMPSON

ON NATURE STUDY



IN CORRESPONDENCE and in the course of my lectures I have been asked a great many times to name some reliable text-book that would serve as a guide in the study of American Zoology, and hitherto, I have been unable to do so.

There are, indeed, one or two excellent popular works on Birds, but nothing on Mammals, Reptiles, or Fishes. Our writers on these subjects have unfortunately grouped themselves under two heads:—

1. THE CAREFUL SCIENTISTS WHO HAVE NEITHER THE WILL NOR THE WIT TO BE POPULAR.
2. THE POPULAR WRITERS WHO WERE UTTERLY UNRELIABLE.

There were of course many partial exceptions to this, but, as a broad fact, notwithstanding the public demand, there has not been until now a reliable work of popular scope on American Zoology, since the days of Audubon.

It is therefore a great pleasure to introduce and commend to the public, THE NEW NATURAL HISTORY, a work that presents, in a popular form, the best results of recent zoological research.

Natural History, as a school course, is a modern study. In the days of our fathers it was not thought of at all, and it is yet very usual to have parents ask of the teacher,—“Why should my boy take up Natural History?” “What is the use of Nature-study?”—and commonly, although he himself is convinced of the desirability of such subjects, the teacher cannot frame a satisfactory reply.

There are several good answers to these questions. The first bears on the value of such studies, as training. No one swings dumb-bells for the sake of doing it, but because he can thereby develop muscles that will serve him in his after-life. So Nature-study, viewed wholly as training, must rank in the highest class. More than any other pursuit within the

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reach of all, it tends to develop powers of correct observation and clear reasoning from cause to effect.

There are many studies which partly cover these same grounds. Thus, History affords ample opportunity for following a complex chain of events, but *not* from first-hand observation; Mathematics develops the powers of reasoning without observation; while Chemistry is almost purely experimental, that is, observational; and Medicine seems to belong to the same list. On the other hand, Surgery and Practical Engineering are as good as, or even better than Nature-work for harmoniously developing the faculties of observation and reason; but these are beyond the reach of the many; and of all the available recognized studies in our schools and colleges to-day, none is a better developer of sight and insight, that is perception and causation, than Nature-study, which has the final advantage of being an active, health-giving, outdoor pursuit.

Next, we may claim that Nature-study adds a new and elevating pleasure to life. According to a noted Roman sybarite—presumably an authority on his own life-study—a new pleasure was worth more than vast riches. In our own day, it will be remembered that the well-to-do of our race spend enormous sums each year, and rightly so, on pictures, music, the drama, and kindred pleasures, while here is one, at least worthy to rank with them, that may be brought within the reach of all; for it is impossible to put even a partially trained naturalist in a situation where he cannot delight himself with his pursuits.

Chilon is credited with having said that Man's most important business is to "know himself." Many other sages have added the weight of their names to this dictum, logically believing that so far as this world is concerned, that man would come nearest to perfection who "knew himself," that is, understood his own powers and limitations, comprehended his place and relations in the universe. This final quintessence of all philosophy was made by a heathen, but the enlightened of our day have changed it only by drawing another circle outside to enclose it all, so that the dictum is still acceptable.

No one can comprehend the nature and purpose of a wheel in some complex machine by study of that wheel alone. He must consider the whole machine, and especially the parts nearest to that particular wheel. Man therefore, seeking to know himself, must fail utterly, unless he remember that he is only a part of the great machine of the universe. He must therefore study the other wheels, that is, the life-forms about him, which are parts of his environment and offspring of the same creative power as himself.

These are reasons which may not appeal to those who pride themselves on being "thoroughly practical," therefore I shall give last, one which should commend itself to them, and which also has the greatest weight with those who view these things on the highest plane.

It is always good to follow the truth for its own sake. It is always safe to do so; it is always wise. However doubtful the path may look at times, it always ends well. Follow the truth and you come to knowledge, and knowledge leads to wisdom.

In the past generations there have always been a few scholarly "curious" gentlemen who found pleasure in studying the aspects of nature and in writing down their observations. Of this class were Gilbert White, Catesby, Bartram, Huber, and a thousand such observers. They did not know what they were working for, and their contemporaries considered them at best mere harmless idlers.

But these men must have felt that they were right. They were blindly following the truth for its own sake. Unwittingly they went on piling up their little ascertained facts or fragments of facts, preparing building material, they knew not for what. But we to-day know that they were storing up bricks and timber for master-builders; they were clearing the way for Darwin and Pasteur and making them possible.

The edifice to which they were blindly contributing was the splendid structure of Modern Science. And to realize how much that has done to help man toward happiness, we should have to ponder a long list of such modern subjects as:—

Electro-therapeutics and Electro-diagnosis, with a large number of the applications of electric power.

Medico-botany, with its superb modern pharmacopœia.

Micro-zoology, Micro-botany, and Bacteriology, shedding sovereign light on most diseases.

Phylogeny, Ontogeny, and Embryology, with their obvious practical bearing on the welfare of our race.

Indeed the whole modern science of Sanitation, with all that it means for the reduction of human misery, is nothing but a practical application of the truths of Natural History.

We must consider all these and realize that each of them was the immediate outcome or offspring of a better knowledge of the laws of life, that is "knowledge of himself," obtained by Man through persistent Nature-study.

All this, it is granted, has been achieved by observation and study of the common things about us. For the future, what further reward is offered? We do not know. We have no way of guessing.

But judging from past experience, we are sure of this: First, that he who simply tells the awkward truth of what he sees, is building better than he knows; while he who tries to make it fit some plan of his own is like an ignorant savage who tries to restore the effacements in a priceless ancient manuscript.

Second, that whosoever, great or small, takes up this work, piling up little scraps of truth, no matter how minute, how seemingly trifling,—it may be only the shape of a mouse's claw, a queer quirk in a grass blade, an unusual hole in a leaf, or the track of a chippy sparrow in the mud,—but so long as he makes his record true, and puts it where it can be found when wanted, he is piling up building material for the next great architect.

What the building will be or when and whence the builder will come, no man can tell. But this we know—that when he does come, the edifice will be wonderful, tremendous, glorious. It will be a newer, better, far more competent shelter from misery for all mankind, than any we have yet achieved, and worth—Yes, ten thousand times more than worth—all the labor that it cost.

This is the ideal as well as the practical end, and would be worth the following if the road there lay through bogs beset with thorns and over grim ascents on sharpest flints. How much more so, since it is, as we know, an alluring pathway of pleasantness and peace.

But however much we may need to set forth in order our reasons for Nature-study, this fact is sure: The world-mind darkly groping has long been trending that way. We are to-day on the crest of a great popular wave of interest in this pursuit. The feeling is no fad, no mere passing whim. Nature, close at hand, was the first study of mankind and after a period of neglect, our race is now returning to it. When Audubon published his "Birds of America," such interests were the amusement of but a few scholarly gentlemen who were not taken very seriously by their friends. But to-day what a change! At least a majority of our young people are devoted to such pursuits, and in nearly all our schools there are special courses to foster the growing interest in Natural History.

The vast number of popular books on Nature-study is probably more the effect than the cause of this, and the prominence given to Nature-work in standard curricula, is good evidence of the value attached to it by those best fitted to direct the mind of youth.

There is no longer any question as to the desirability of a nature course; the educators differ only as to method. One party advocates a synoptic view of creation, another prefers to direct attention primarily to the familiar

life-forms around us. A third, probably the wisest, believes in a method compounded of both. This is the theory of the teachers whose labors have produced *THE NEW NATURAL HISTORY*.

This work is under the editorship and largely from the pen of Mr. Richard Lydekker, whose contributions to Geographical and General Zoology have given him a place among the most eminent living naturalists. It consists of six large quarto volumes (12 sections), elaborately illustrated, and treating broadly the whole Animal Kingdom.

Each large group is introduced in a synoptic chapter, detailing its general characteristics, its features of especial interest, its relation to the other groups, its geographical distribution, and the more important known facts bearing on its evolution.

Then follow chapters dealing in detail with the more interesting members of that group from all over the globe. Admirable portraits from the pencils of the best artists are found on nearly every page, and in a chapter on the habits of the creature are condensed the interesting facts that are known concerning it. Finally, to each group is added a review of its fossil relatives, with remarks on their affinities.

Volumes I, II, and half of III are devoted to Mammalia, and are entirely by Mr. Lydekker. The latter half of Volume III and all of Volume IV are given to Birds; of the twenty-one chapters, eleven are by Mr. Lydekker, five by Rev H. A. MacPherson, three by Dr R. Bowdler Sharpe, and two by Mr. W. R. Oglivie Grant.

Volume V is on Reptiles and Fishes, and is entirely by Mr. Lydekker. Volume VI is on the Invertebrates; it contains sixteen chapters, of which four are by Mr. R. I. Pocock, three by Mr. Edgar A. Smith, two by Mr. Octavius Pickard-Cambridge, two by Messrs. H. and M. Bernard, two by Mr. R. Kirkpatrick, two by Mr. C. J. Gahan, and one by Mr. F. A. Bather. All of the contributors are men of recognized high standing in their special departments.

The scope of the work being cosmopolitan raises the question of its especial adaptability to American use and this justifies a somewhat geographical analysis. In the two and a half volumes devoted to the Mammalia some twelve hundred species are treated individually in more or less detail, and of these, about four hundred, that is one-third, are American. In some of the groups the proportion is yet greater. Thus out of one hundred and eighty Rodents nearly one-half are New World species; of one hundred and fifty Bats, more than half are American; of fifty odd Cetaceans, thirty-four, or about two-thirds, are found in American waters; and out of the twenty-four Edentates described, nineteen, or more than three-fourths, are species peculiar to the Western Hemisphere.

This ratio does not mean that the Americas are faunally richer than the other continents, but rather that American naturalists have been more active and have supplied the scientist with more material than the others.

It must, however, be remembered that the public demand is for Natural History lore of two kinds:—

First—Concerning the wild creatures one occasionally sees in the woods.

Second—Concerning the strange animals one continually sees in menageries and museums.

As a matter of fact the latter are sometimes nearer to us, more truly ours, than are the natives of our own country. It is tolerably certain that more persons know, see, and are interested in an Indian Leopard, not to say an African Lion, than in the Ocelot of Central America and Mexico. More persons are curious about the East Indian Bird of Paradise than about its distant relative, our own Rio Grande Xanthura, and are much more likely to be familiar with the Elephant from Africa, than with its American representative, the Tapir from Guatemala.

Thus it will be seen that a large number of animals which have a place in menageries and museums, as well as in literature, have established greater claims on our notice than have rare and obscure species in our own country.

To meet this condition THE NEW NATURAL HISTORY is happily conceived. The child, as well as the professor, can turn to it certain to get the latest general facts about the new strange creature that has arrived at this or that menagerie. He can there learn something of its habits, its country, its relations to other and better known forms, and also inform himself about that other creature that was trapped the night before, in the hen-house of his farmer neighbor.

There is about this work little to criticise. Advanced American systematists may take exception to the somewhat antiquated nomenclature which occasionally appears. The school to which the editor belongs has yet to learn the lesson accepted years ago by the American systematic zoologists, that priority is the only stable foundation for taxonomy. But this objection is not likely to appeal strongly to the public, especially as Mr. Lydekker has erred on the side of conservatism.

The strongest features of the work are the masterly generalizations with which each group is introduced—generalization for the most part from the pen of the editor—and the vast collection of superb illustrations.

To this latter most of the leading animal-artists have contributed, and the result is probably *the best general series of nature illustrations ever brought together in one publication*—a series worthy of the text and forming with it a work that is easily the best and most reliable in the field of popular Natural History, and one that is not likely to be superseded in the near future.

Ernest Innes Thompson

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MAMMALS

CHAPTER I

GENERAL CHARACTERISTICS—CLASS *Mammalia*

IN describing any group of objects, whether they be artificial or whether they be natural, some method of classifying is absolutely essential to a right understanding of their relations to one another; and nowhere is this more important than in Natural History. To a certain extent such a classification is already made in our ordinary language, since we are accustomed to divide the higher animals into several distinct primary groups, under the names of Mammals or *Quadrupeds*, Birds, Reptiles, and Fishes; and these primary groups coincide in the main with those employed by zoologists. Such a popular classification depends almost entirely upon similarity or dissimilarity of outward appearance and form; and although this is a good and dependable guide in many cases, it is by no means always trustworthy, and may, indeed, frequently lead us into serious error. For instance, whales and dolphins are generally associated in the uninstructed mind with fishes, whereas, as a study of their internal structure at once reveals, they are really Mammals, which have been specially adapted for a purely aquatic life.

To arrive, therefore, at a correct idea of the mutual relations and affinities of animals, and thus to formulate a natural scheme of classification, it is absolutely essential to have a certain knowledge of their internal anatomy, as well as of their external appearance and their habits. Since, however, such intimate knowledge can only be attained after a protracted course of study quite impossible for the majority of persons to undertake, it is unavoidable that they must receive a good deal on trust from those who have devoted their time to such studies. And yet, with a certain amount of attention, every reader should be able to comprehend some of the main and leading characters in the structure of animals, by means of which they are classified and arranged in a series, which may either commence (as in this work) with the highest and descend to the lowest, or may take the opposite direction.

Species and Genera In regard to classification, we commonly divide animals into what the zoologist terms species. Thus all the individuals of the animal we call a rat constitute a *species*, while all those to which we apply the name mouse form a second species. The rat and the mouse are, however, obviously closely allied species, and are accordingly grouped together by the zoologist as a *genus*, in this particular instance termed *Mus*. In the large majority of instances there is no great difficulty in deciding what is a species, but opinions may legitimately differ as to what amount of variation between particular species is necessary in order that they should be assigned to different genera.

Besides the rat and the mouse, there are, however, found in many parts of the world certain other animals, known as voles, which differ so markedly from rats and mice as clearly to form a distinct genus (in the case termed *Microtus*), although allied to them in so many points as to show that they are very near relations.

Families and Orders Such nearly related groups of species or genera are accordingly grouped together in a *family*, which takes its name from one of the component genera. We, accordingly, have the genera *Mus* and *Microtus* constituting the family *Muridæ*; but the number of genera in a family may be much larger than this, while in a few instances a family is represented by one genus only.

All, however, who have ever observed with any ordinary attention such animals as rats, hares, beavers, and guinea-pigs, will have noticed that there is a general similarity in their outward appearance, and that all of them have a single pair of chisel-like teeth in both the upper and lower jaw, with which they are in the habit of gnawing their food, or any obstacles they may wish to remove. Animals thus obviously related to another, although differing in other respects too widely to be included in a single family, constitute an *order*, or assemblage of families; the animals to which we have alluded forming the order of Rodents, or *Rodentia*, which will thus include the families *Leporidae* (hares and rabbits), *Muridæ* (rats and mice), *Castoridae* (beavers), *Caviidae* (guinea-pigs), and many others.

Classes Our grouping by no means ends, however, with an *order*, for we find that groups of orders, from the possession of one or more common characters by all of them, may be brigaded together as classes. Thus the Rodents, the Hoofed Animals or Ungulates (pigs, deer, cattle, horses, etc.), and the Carni-

vores (cats, dogs, etc.), which form three distinct orders, all agree with one another in that their young are nourished by milk sucked from the mother. Consequently such animals, together with all others showing the same peculiarity, are grouped together to form the class of Mammals or Mammalia.

If, however, a mammal, a bird, a reptile, and a fish be compared together, it will be found that although the three latter differ from the former, in that the young are not suckled by the female parent, yet all agree in the possession of what we commonly call the *backbone*; this backbone consisting of a column running along the back of the animal, and composed of a number of jointed segments, which, although usually formed of bone, may be of cartilage. Such joints are technically known as *vertebræ*, and the whole column as the *vertebral column*; while all the classes possessing this vertebral column are grouped together under the name of Vertebrates, or Vertebrata, this largest group being known as a subkingdom.

We accordingly have a scheme of classification like the following:—

Subkingdom **VERTEBRATA**, or Vertebrates.

Class **Mammalia**, or Mammals.

Order **RODENTIA**, or Rodents.

Family **MURIDÆ**, or Rats and Voles.

Genus *Mus*, Rats and Mice.

Genus *Microtus*, Voles.

**Structure
of the
Vertebrates**

In saying that the Vertebrates, or highest of all animals, are characterized by the presence of a backbone or vertebral column, we have given only the primary feature of this great group; and we must accordingly say a few words more on the subject of their structure. Now an essential feature in the structure of all Vertebrates is that on that side of the backbone lying nearest to the back there runs a tube or canal, formed by arches of bone or cartilage springing from the bodies of the *vertebræ*, within which tube is the so-called spinal marrow or cord, which is a rope-like structure formed of nerve-tissue, and running backwards from the brain to the hinder extremity of the body. On the opposite side of the backbone to that occupied by the spinal marrow there is a much larger cavity containing the viscera, such as the heart, lungs, stomach, etc. In a cross-section of the body of any vertebrate animal we therefore see two tubes—a small one containing the nervous system placed above the backbone, and a much larger one containing the viscera situated below the backbone.

Another noteworthy peculiarity of Vertebrates is that the limbs, which never exceed four in number, are always directed away from that part of the body which contains the nervous system, and towards that enclosing the viscera; whereas in nearly all the lower animals, collectively known as the Invertebrates, the reverse is the case. Vertebrates are likewise distinguished by the circumstance that the two jaws work in a vertical plane, or, in other words, are upper and lower, instead of being right and left, as they are in insects.

Having said thus much as to the general characters of the Vertebrate subkingdom, we come to the consideration of those of its highest class, the Mammals.

With the exception of the word Beasts, we have no true English term for this group of animals. The term Quadrupeds was, indeed, long in popular use, but since it is inapplicable to whales, while it would also include most Reptiles, it is now largely superseded by the term Mammals, derived from the most obvious peculiarity of the class.

Characteristics In addition to the presence in the females of mammary glands of the secreting the milk, by means of which the young are nourished, **Mammals** Mammals differ from the other higher Vertebrates by the mode in which the lower jaw is articulated to the skull. Thus in other Vertebrates this articulation is effected by the intervention of a separate squared bone, known as the quadrate, upon the lower end of which the articular hollow of the lower jaw plays, while its upper end is articulated to the skull proper. In Mammals, however, this intermediate bone is absent, and the lower jaw consequently articulates by means of a convex surface, or condyle, directly with the walls of the skull itself. Moreover, in all Mammals, each half of the lower jawbone consists of but a single bone, instead of several distinct bones joined together. Thus an isolated jawbone is always sufficient to prove whether its owner was a Mammal or some other Vertebrate. Another very important feature of Mammals is that they always have hair (although it may be only a few bristles on the mouth) on some portions of their bodies during a certain period of their existence. Again, that portion of the large cavity of the body which contains the heart and lungs is completely separated by a horizontal partition, known as the midriff or diaphragm, from the one containing the stomach and intestines. Moreover, at least in all living members of the class, the brain of Mammals is much more highly organized than that of other animals; one of its distinctive features being the presence of a transverse band on its lower surface, by means of which its two lateral halves are intimately connected together.

The above are a few of the chief features distinguishing Mammals from all other Vertebrates, but we may now briefly notice some in which they differ from certain of the lower classes, although agreeing with others. One of the most important of these differences is that the skull of Mammals is jointed to the first vertebra by means of a pair of transversely disposed bosses, or condyles, as they are technically called. In this respect Mammals are broadly distinguished from Birds and Reptiles, in which there is but a single condyle, placed in the middle line of the skull. Frogs and newts, constituting the class of Amphibians, agree, however, with Mammals in the mode by which the skull is jointed to the backbone; although they differ from them very widely in other parts of their organization.

Circulation On the other hand, Mammals differ from Fishes, Amphibians, and Reptiles, in having warm blood, which is propelled from a four-chambered heart through a double circulatory system; one part of this system causing the blood to pass through the lungs for the purpose of taking in a fresh supply of oxygen from the air, and the other being subservient to the supply of freshly oxygenated blood to the various organs and members of the body. This circulatory system also differs from that of Birds and Reptiles in that the blood for the nourishment of the body is propelled from the heart by a single vessel known as

the aorta, which passes over the left branch of the windpipe; whereas in the other two classes mentioned the aorta crosses either the right branch or both branches of the windpipe.

Respiration All Mammals, whether they live on the land or in the water, breathe air by means of lungs suspended in the chest; and during no period of their life do they ever develop gills; neither do they ever undergo a metamorphosis analogous to that presented by the change of a tadpole into a frog. By these last two negative characters they are, therefore, sharply distinguished from the Amphibians, with which, as we have seen, they agree in the mode by which the skull is articulated to the first joint of the backbone.

Young With the sole exception of the egg-laying Mammals, or Monotremes, of Australia and New Guinea, which are the lowest members of the class, the young of Mammals are invariably born in a living condition.

Vertebræ of Neck A remarkable feature in Mammals is the circumstance that, with only three constant exceptions, the number of joints, or vertebræ, in the neck is seven; this number being equally constant in the enormously elongated neck of the giraffe, or in the extremely shortened one of the whale, where the vertebræ are reduced to thin plates of bone.

Structure As a rule, Mammals have the two pairs of limbs characteristic of Vertebrates, but occasionally, as in the whales, the hinder pair may be wanting. In a large proportion of species the hind- and fore-limbs are of approximately equal length. In some cases, however, the hind-limbs may be enormously elongated at the expense of the fore-limbs, as we see in the kangaroos and jumping mice; and progression is then effected by means of leaps and bounds from these strong hind-limbs. The opposite extreme of limb-structure is shown among the bats, where, while the hinder pair retain their normal structure, the fore-limbs are enormously elongated to afford support to a leathery wing-like structure, by means of which these strangely modified creatures are enabled to fly in the air with the same ease and swiftness as Birds. In the whales and dolphins, which lead a purely aquatic life, we find the fore-limbs modified into paddles for swimming, while the hind ones are, as we have said, totally wanting. Similar conditions obtain in the dugongs and manatis; but in the true seals, which are less completely aquatic, the hind-limbs are still well developed, although directed backwards to form, in connection with the tail, a kind of rudder. The bats are the only Mammals which are wholly adapted for flight, but we meet with certain forms in other groups, such as the flying squirrels among the Rodents, and the flying phalangers among the Pouched Mammals, which are enabled to take long leap-like flights from tree to tree by means of a kind of a parachute formed of folds of skin running along the sides of the body from limb to limb. The limbs themselves are not, however, specially modified; and true flight, in the sense of propulsion caused by up-and-down strokes of the fore-limbs, is not performed by these Mammals. We shall have something more to add on the subject of limbs in the paragraphs devoted to the skeleton.

Almost as great variations are displayed in the modifications and uses of the tail of Mammals. In the majority of cases the tail is present and forms a tapering

axis, often clothed with long hair, which may considerably exceed the total length of the body. The Mammal, in which the relative length of the tail is greatest, is a small one from Madagascar, belonging to the Insectivorous order, and named *Microgale*, in which the tail is nearly three times as long as the body. In some of the apes and monkeys the tail is absent; and it is very short in the bears among the Carnivores, and in many deer among the Hoofed Mammals, or Ungulates. In many Ungulates, however, such as cattle, it is of great length; and in that group it has its extremity furnished with a tuft of hair, and thus forms an effectual instrument for brushing away flies from the body. In the spider-monkeys of South America, as well as in the opossums and phalangiers, in certain porcupines, and other forms, the tail is prehensile, and thus serves as an important aid in climbing, or to suspend its owner's head downwards. In the beaver the tail is expanded into a flattened oar-like form, which probably acts as a rudder in swimming. But the most remarkable modification of this useful organ occurs in the whales and dolphins, when it is expanded into a large forked structure, termed by whalers 'flukes,' and is the main organ in propelling the body through the water.

In regard to the external covering, we have already said that hairs are always present on some portion of the body during some period of life. In the whales these hairs may, however, be reduced to a few bristles in the region of the mouth, which disappear when the animal attains maturity. Mammals never develop that modified kind of hair-structure known as feathers, which are peculiar to Birds. The body may, however, be covered with overlapping scales, like those so common in Reptiles, but this occurs only in the pangolins, or scaly ant-eaters of India and Africa. The tail of the common rat is an example of a part of the body covered with scales, having their edges in apposition; but in both these instances hairs are mingled with the scales. Still rarer than scales are bony plates, developed in the true skin. At the present day these structures are only met with among the well-known armadillos of South America, which are furnished with bucklers and transverse bands of these bony plates, and are in some cases able to roll themselves up into a ball, presenting on all sides an impenetrable coat of mail. In the Pleistocene, or latest geological period before the present, South America produced, however, a number of huge Mammals allied to the armadillos, and known as glyptodonts, which were covered with a continuous cuirass of bony plates, reaching in some cases more than an inch in thickness. That these huge and well-armed forms, which one might regard as typical examples of animals fitted to withstand all enemies, have perished, while their smaller and less completely defended allies have lived on, shows us that there are other causes at work than the attacks of foes in the destruction of animals. Between the plates of the armor of the armadillos hairs are always developed, and in one species these are so abundant as to completely hide the plates themselves, and render the general appearance that of an ordinary hairy Mammal.

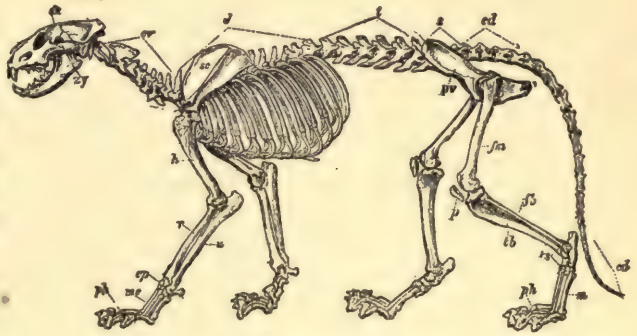
The use of hair is mainly to protect the body from cold, and thus to aid in the maintenance of a uniform high temperature; and when hairs are absent, we find this function performed by a more or less thick fatty layer beneath the skin, which, when it is excessively developed, as in the whales, is known as blubber. To com-

pensate for the difference between the temperature of winter and summer, many Mammals which inhabit the colder regions of the globe develop a much thicker coat of hair in the former than in the latter season, of which we have an excellent example in the horse. In some Mammals, such as the hare and cat, the body is covered with only one kind of hair; but in other cases, as in the fur-seals, there is one kind of long and somewhat coarse hair, which appears at the surface, and another of a softer and finer nature, which forms the thick and warm under-fur. This under-fur is greatly developed in Mammals of all groups inhabiting Tibet, where it is locally known as 'pashm'; and it is this pashm of the goat of these regions which affords the materials for the celebrated Kashmir shawls. Curiously enough, too, animals which usually do not develop pashm almost immediately tend to its production when taken to the Tibetan region, as is notably the case with dogs. Less frequently the hair of the body takes the form of stiff bristles, as on the pig; and still more rarely this thickening is carried to such an extent as to produce spines of which we have the best instances in the porcupine and hedgehog, belonging, it should be borne in mind, to distinct orders.

The solid horns of the rhinoceroses, and the hollow horny sheaths of cattle and antelopes are very similar in their nature to hairs, and may indeed be compared to masses of hair welded together into solid structures.

Although a fair idea of Mammals as a whole may be gained without investigation into the nature of their soft internal parts, yet any one who desires to obtain any really accurate knowledge of them must make up his mind to acquire at least some slight idea of the general structure of the bony skeleton, and also of the form and nature of the teeth, since these parts are of the highest importance in classification.

We have already incidentally mentioned that the skull consists of two portions,—the skull proper, which contains the brain, and the lower jaw. It will suffice to mention, in addition, that the hinder part of the skull is known as the occiput, and that on the front surface the pair of bones roofing over the cavity of the nose are known as the nasals, while those behind them, forming the region of the forehead, are termed frontals. Further, in the upper jaw, the bones, which carry the hinder- or cheek-teeth are known as the maxillæ, while those in which the front cutting-teeth are implanted are termed the premaxillæ. All the other numerous bones of the skull have received distinct names; but the reader desirous of becoming



SKELETON OF THE LION.

sk. skull; *zy.* cheek-bone (zygomatic arch); *cv.* vertebræ of the neck; *d.* vertebræ of the back; *l.* vertebræ of the loins; *s.* sacrum; *cd.* vertebræ of the tail; *sc.* shoulder-blade (scapula); *h.* arm-bone (humerus); *r. u.* bones of fore-arm (radius and ulna); *cp.* wrist (carpus); *mc.* metacarpus; *ph.* toe-bones; *pv.* haunch-bone (pelvis); *fm.* thigh-bone (femur); *p.* knee-cap (patella); *tb. fb.* bones of the lower leg (tibia and fibula); *ts.* ankle (tarsus); *m.* metatarsus.

acquainted with them must refer to other works. Our notice of the other parts of the skeleton must be equally brief. In the backbone or vertebral column, the first vertebra, or that which articulates with the skull is known as the atlas; following which is the axis vertebra, remarkable for having the body or basal portion of the atlas vertebra fixed to it, and known as the odontoid process. This separation of the body of the atlas vertebra from its proper segment is constant throughout the greater part of the vertebrate subkingdom. The remaining five of the cervical, or neck-vertebræ, are distinguished from the dorsal, or vertebræ of the region of the chest, by the absence of ribs. The ribs of most of the dorsal vertebræ articulate in the middle line of the inferior aspect of the body with the breastbone, or sternum, which is itself composed of several segments. The dorsal vertebræ are succeeded posteriorly by a smaller number, forming the region of the loins, which have no ribs, and are termed lumbar. Behind the latter there are several coalesced vertebræ forming the so-called sacrum, to which the haunch-bones articulate; and these are again succeeded by the tail, or caudal vertebræ, of which the number varies according to the length of the tail itself.

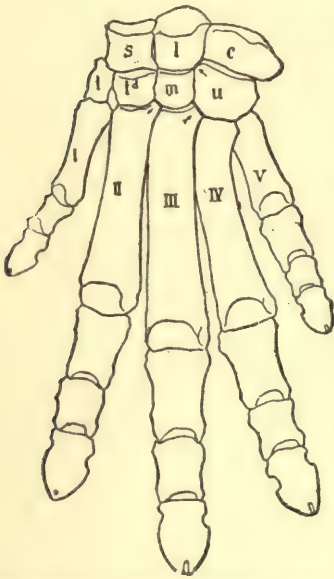


DIAGRAM OF THE BONES OF THE
LEFT FORE-FOOT OF A FIVE-
TOED MAMMAL (*Phenacodus*).
($\frac{1}{2}$ nat. size.)

The bones marked *s*, *l*, *c*, *t*, *td*, *m*, and *u*, form the wrist; those numbered *I-V* are the metacarpals, and the remainder the finger- or toe-bones.—After Osborn.

In the majority of Mammals the fore-limb is connected with the trunk simply by the blade-bone, or scapula, which lies on the back surface of the anterior ribs; and in front by the collar-bone, or clavicle, which connects the scapula with the sternum. The bones of the fore-limb are, firstly, the arm-bone or humerus, which has condyles at its lower end; and, secondly, the two parallel bones of the fore-arm, of which the outermost (when the palm of the hand is turned forwards) is the radius, and the other the ulna. The radius is always present, but in many Hoofed Mammals only the upper end of the ulna remains, which is fused with the radius. The radius articulates below with the upper of the two transverse rows of small solid bones forming the wrist or carpus; beyond these we have in man and monkeys, as well as in certain other groups, five elongated bones, termed metacarpals, the four outermost of which are succeeded by the three phalangeal bones of the fingers or digits. The thumb, or first digit, which lies on the same side as the radius, has, however, only two of these phalangeals.

The hind-limb differs from the fore-limb in that the innominate, or haunch-bones, which together form the pelvis, are connected by an immovable bony union with the sacral region of the vertebral column.

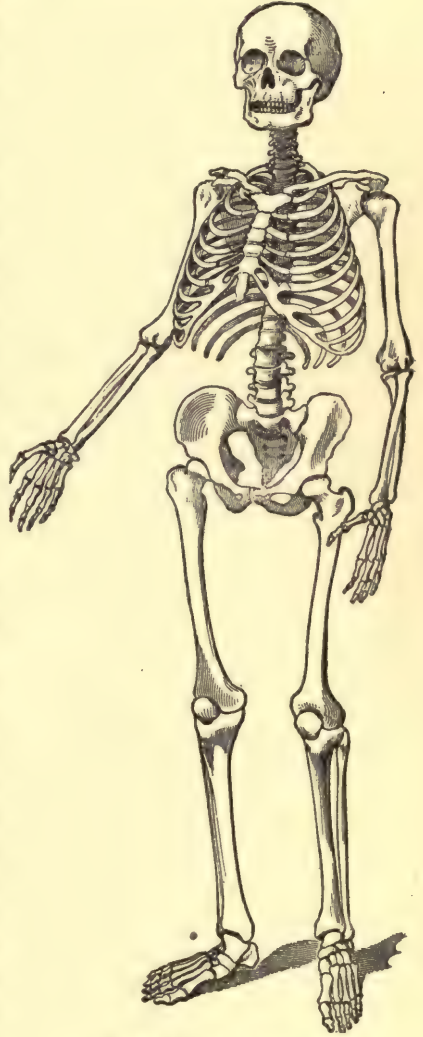
The thigh-bone or femur, corresponding to the humerus of the arm, articulates with a cavity in the innominate, termed the acetabulum. The leg has two parallel bones articulating with the lower end of the thigh-bone or femur; of which the larger, or

tibia, occupying the inner side of the limb, corresponds to the radius of the fore-arm, while the smaller outer bone, or fibula, represents the ulna. The ankle, or tarsus, corresponds to the carpus in the fore-limb, and likewise consists of two transverse rows of small bones. Two bones of the uppermost row, *viz.*, the calcaneum, or heel-bone, and the astragalus or ankle-bone, are specially modified. In the foot proper the bones correspond with those of the hand; those representing the metacarpals being, however, termed metatarsals. It will frequently be found convenient to speak of the extremity of the fore-limb, or hand, as the *manus*; while the hind foot may be termed the *pes*.

In the foregoing summary we have spoken of the hand and foot as consisting of five fingers and toes, or digits; and this is the case with most Monkeys, many Carnivores, Rodents, etc. In other cases, however, and especially among the Hoofed Mammals or Ungulates, there is a tendency to the reduction of the number of digits. Thus in the cattle and deer, commonly known as Ruminants, the number of functional digits is reduced to two, corresponding to the third and fourth of the typical series of five; while in the horse only a single digit remains, which in the fore-limb corresponds to the middle or third finger of the human hand, and in the hind-limb to the middle toe.

Arrangement of the Teeth Almost all Mammals when adult have both jaws provided with a series of teeth, varying greatly in number and structure in the different groups. These teeth are almost invariably fixed in separate sockets; and while the front teeth have but a single root or fang, the side- or cheek-teeth very generally have two or more such roots, each of which occupies a separate division of the socket. In all cases the teeth are fixed in their sockets merely by the aid of soft tissues connected with the gum, and are never welded to the jaws by a deposit of bone. Very generally there is a sharply-marked line of division, termed the neck, between the root, or portion of the tooth implanted in the jaw, and the crown or exposed portion.

In most of those Mammals, in which the teeth of different parts of the jaw differ in structure from one another, there are two distinct sets of teeth developed



HUMAN SKELETON.

during life. The first of the two includes the milk- or baby-teeth, which are generally shed at a comparatively early age, are of small size and few in number, and are finally succeeded by the larger and more numerous permanent set, which remain during the rest of life, unless previously worn.

In those Mammals in which the permanent teeth differ from one another in form in different regions of the jaw, we are enabled from their position, and also from their relations to the temporary series of milk-teeth, to divide them into four distinct groups. Taking one side of the upper jaw, as that of the dog, of which the teeth are shown in the figure, we find the front bone or premaxilla, carrying a small number (in this instance three) of simple cutting teeth, termed incisors. Behind these teeth, from which, as in the figure, it is generally separated by a longer or shorter gap, there is a tooth with a simple and often conical crown, which, like the incisors, is inserted in the jaw by a single root. This tooth, which is usually larger than the incisors, is termed the tusk or canine tooth, and in the wild boar and most Carnivorous Mammals attains a very large size. It can always be distinguished from the incisors by the fact that it is implanted in the maxilla, or second bone of the jaw, or at least on the line of junction between that bone and the premaxilla. Behind the canine we have a series of teeth, which may be as many as seven, although only six in the figure, with more complicated crowns, and, except the first, inserted in the jaw by two or more roots. This series may be collectively known as the cheek-teeth; but they may be divided into two minor groups according as to whether they are preceded by milk-teeth or not. In the dog the four



OUTER VIEW OF THE RIGHT MILK AND PERMANENT UPPER TEETH
OF THE DOG.

The lower row are the milk-teeth, and the upper the permanent
teeth.—After Sir W. H. Flower.

teeth immediately behind the canine, with the exception of the first, are the vertical successors of milk-teeth, and are known as premolars; while the two hindmost teeth, which have no such temporary predecessors, are known as true molars, or molars. In the lower jaw the tooth, usually larger than the others, which bites in front of the upper canine is the lower canine. In advance of this tooth are the incisors, and behind it the premolars and molars, distinguished from one another in the same manner as are the corresponding teeth of the upper jaw.

With the exception of the Pouched Mammals, with which we shall not have to deal till we come to the middle of the third volume, there are, in practically all the Mammals with teeth of different kinds, never more than three incisors, one canine, four premolars, and three molars on either side of each jaw; so that the total number of teeth on both sides of the two jaws is not more than forty-four. In the

figured upper jaw of the dog the number falls short of this full complement, owing to the circumstance that there are only two in place of three molars.

Dental

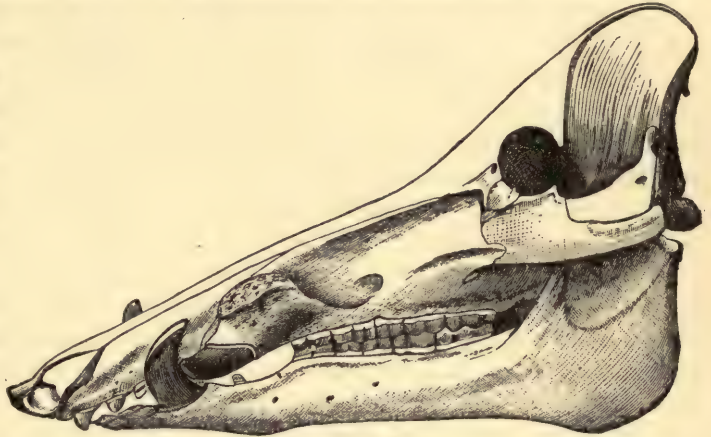
Formulae

As it would be exceedingly inconvenient always to have to describe the number of teeth in any given Mammal by writing them down at length, a graphic formula has been invented by which the number of teeth of each species can be shortly and clearly expressed. Thus, taking only one side of each jaw, and indicating the incisors by the letter *i*, the canines or tusks by *c*, the premolars by *p*, and the molars by *m*, and taking the numbers above the lines as representing the teeth of the upper, and those below the same the teeth of the lower jaw, we may express the number and kinds of the teeth of the dog by the

formula: $i_{\frac{3}{2}}, c_1, p_{\frac{4}{1}}, m_{\frac{2}{2}}$.

The total thus given is 21, and double this number will of course give the entire number of teeth on both sides of the two jaws, which in this case will be 42.

Structure of the Teeth A few words must now be said regarding the internal structure of teeth, as without this it is quite impossible to understand the modifica-



SKULL OF PIG.

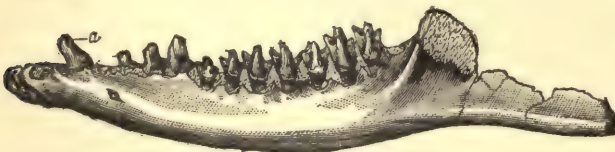
To show distinction between incisors, tusks, and cheek-teeth.—After Nehring.

tions which they undergo in different groups of Mammals. Taking a simple more or less conical tooth like the tusk of a lion or tiger, or any tooth of a sperm whale, it may be observed that when such a tooth first appears above the gum it is open at the base, where it forms a hollow cone. And in teeth like the tusks of the elephant, which grow throughout the whole life of their owner, such a condition remains permanent. Usually, however, a tooth ceases to grow after a certain period, and the base of the root or roots then becomes completely closed, and assumes a pointed shape. A tooth of this simple conical type is composed internally of a substance known as the ivory or dentine, coated externally with a thin layer of a much harder nature and highly polished appearance, which is termed the enamel. Moreover, outside the base of the crown there may be patches of a coarser substance, called the cement. A model of such a tooth may be made by taking the finger of a kid glove, filling it with beeswax, and putting some smears of sealing wax at the base of the outer surface, when the beeswax will represent the ivory, the kid the enamel, and the sealing wax the cement. If we then cut off the summit of the finger we shall have a central disc of beeswax (ivory) surrounded by a circle of kid (enamel), which will represent the condition of such a type of tooth when its summit has been worn away by use against the opposing tooth of the opposite jaw. If, however, before cutting off the end of our model, we indent the summit with

several deep pits, and also mark the sides with one or more grooves, and fill up such pits and grooves with sealing wax, it is obvious that we shall have a much more complex type of structure. This complex model will serve to explain the type of tooth structure found in many of the Hoofed or Ungulate Mammals; and it will be obvious that if we now cut off the summit of our model we shall find a series of irregular discs of beeswax (ivory), each surrounded by a sinuous border of kid (enamel), in the folds of which will be masses of sealing wax (cement). Such a model will enable us to understand the nature of the cheek-teeth of the Ungulate Mammals when we come to them.

Importance of Mammals to Man From a utilitarian point of view Mammals are of extreme importance to man, since it is from them—and more especially from the Ungulate order—that by far the greater part of his animal food is procured, while their skins or fur furnish him largely with raiment; and it is from their ranks alone that all his beasts of burden and draught are recruited. Moreover, since these creatures are the highest representatives of the animal kingdom, among whom man himself must, from a zoological standpoint, be included, their study is one which commends itself most forcibly to all who are in any way interested in Natural History.

Mammals in the Past Numerous as are the Mammals now living, it must never be forgotten that they form but a small moiety of those which flourished at earlier periods of the history of our earth. The Mammals of the present day may, indeed, be compared to the topmost branches and twigs of a giant forest tree, of which the larger limbs and trunk are concealed from our view. And it will accordingly be manifest that any one who confines his studies to the existing species will have but a very imperfect idea of the whole array of Mammalian life, and of the mutual connection of its various branches. The study of fossil Mammals is, however, a difficult one, and one requiring an extensive knowledge of comparative anatomy. All that can, therefore, be done in a work of the present nature is to call attention, as occasion arises, to some of these extinct Mammals which are of especial importance and interest as showing the manner in which groups now widely separated from one another were formerly more or less completely connected.



THE LEFT HALF OF THE LOWER JAW OF AN EXTINCT
POUCHED MAMMAL.

From the Cretaceous Rocks of North America. The tusk is
marked *a*.—After Marsh.

Although the number of extinct Mammals is very large, yet by far the greater proportion of these belong to the latest of the three great epochs into which the geological history of our globe has been divided. Whereas, during the long-past epoch known as the Secondary period, during

which our chalk and oolites were deposited, the earth was tenanted by gigantic reptiles of strange form, it is not till we come to the rocks overlying the chalk, such as the London clay and overlying strata, that we find Mammals taking an important

place among the inhabitants of the earth. It was, indeed, during this so-called Tertiary period that these animals attained the dominant position which they now occupy; and the present stage of the earth's history may be truly called the age of Mammals and Birds. We are not, however, to suppose from this that Mammals were unknown before the Tertiary period; a considerable number of species, mostly of small size, having been already discovered.

An additional importance attaches to the study of extinct Mammals, since it is by their means alone that we are able to explain several apparent anomalies in the geographical distribution of living groups. How, for instance, could we possibly explain the present existence of tapirs only in such widely remote areas as the Malay Peninsula and Islands and South America, unless we had learned by geological explorations that these animals formerly roamed over large portions of Europe and Asia, from whence their descendants gradually migrated to the regions where they now remain?

The former occurrence of an epoch of great cold in the northern hemisphere known as the Glacial period, furnishes us with an explanation of how nearly related animals are now confined to isolated mountain chains; their ancestors having been enabled, during the prevalence of the cold, to spread over the plains of the temperate regions, from whence they retreated with the advent of warmer conditions to seek a congenial climate in the nearest mountain region.

Mammals may be divided into eleven main groups or orders, which
Orders of may be arranged as follows, and will be treated of in the same se-
Mammals quence, *viz.*:—

1. Apes, Monkeys, and Lemurs—PRIMATES.
2. Bats—CHIROPTERA.
3. Insectivores—INSECTIVORA.
4. Carnivores—CARNIVORA.
5. Hoofed Mammals—UNGULATA.
6. Manatis and Dugongs—SIRENIA.
7. Whales and Porpoises—CETACEA.
8. Rodents—RODENTIA.
9. Sloths, Anteaters, etc.—EDENTATA.
10. Pouched Mammals—MARSUPIALIA.
11. Egg-laying Mammals—MONOTREMATA.

It is not to be supposed that all these groups are separated from one another by differences of equal importance. For instance, No. 10 differs from the preceding groups by characters of far more importance than do any of those nine from one another; while the members of No. 11 differ fundamentally, not only from the first nine groups, but almost equally markedly from No. 10.

Having said thus much by way of introduction, we proceed to the consideration of the first order of Mammals.

CHAPTER II

APES, MONKEYS, AND LEMURS — ORDER PRIMATES

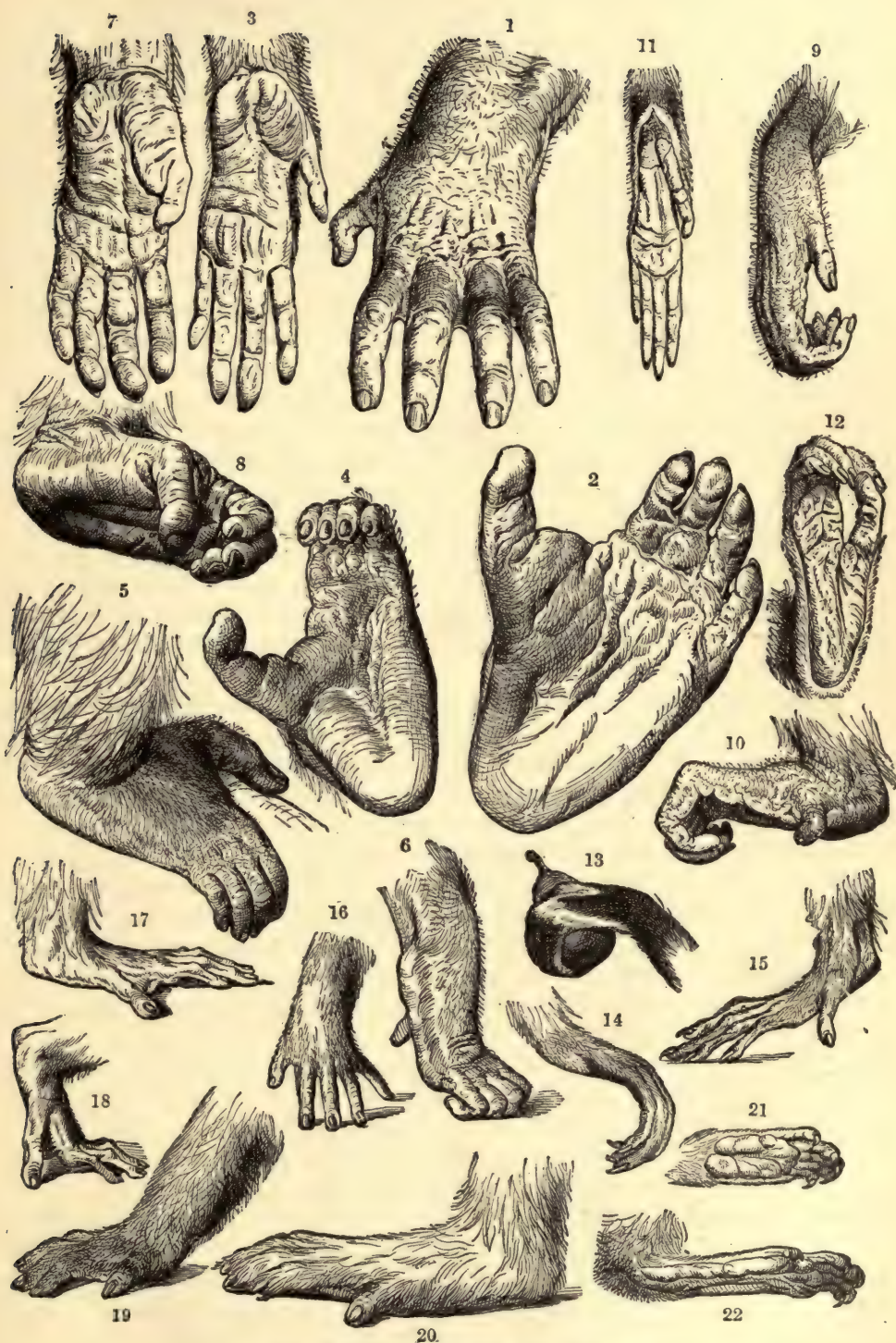
THE MAN-LIKE APES

Family *SIMIIDÆ*

EVERYBODY knows what an ape or a monkey is, and the proverb "mischievous as a monkey" reveals the estimation in which the latter animals are commonly held. The more or less human-like form, the frequent tendency to assume an upright position, coupled with their hand-like feet, would be amply sufficient to distinguish the group to which these animals belong from all others, were it not for the circumstance that there are the less well-known creatures termed Lemurs, which, while evidently related to monkeys, yet differ from them in so many respects as to render it almost or quite impossible to give any characteristics which will absolutely distinguish the order to which they belong from all others. This is, however, a difficulty with which the zoologist has often to put up with, and to make the best of.

That the higher apes are closely related in their bodily structure to man is obvious to all, and it is a fact that the differences between some of these apes and man are, from a purely anatomical point of view, of far less importance than those by which the lower monkeys are separated from the higher apes. It has, indeed, been attempted to show that apes and monkeys are sharply distinguished from man by the circumstance that while man is two-handed, apes and monkeys are four-handed. The difference between the foot of one of the larger apes and that of man is, however, merely one of degree, and is much less than that between the apes and the lowest representatives of the order, as is well shown in the accompanying illustration, which illustrates the various forms assumed by the hand and foot of these animals.

Although the larger apes are those which come nearest to man in their general organization, yet the strong ridges on the skulls of the adults, and the consequent overhanging and prominent eyebrows, give them an expression which, at the best, is but a gross caricature of the human countenance. It is, however, in the young of these animals, where the ridges on the skull are much less developed, and the tusks or canine teeth of the males have not attained the dimensions which they reach in the adult state, that we find a much more human-like cast of expression. Moreover, some of the smaller apes, in which the great ridges on the skull are never developed, approach much more nearly in the shape of their skulls to the human type. The larger apes are, indeed, repulsive animals in the adult condition; and it is usually only the smaller kinds of monkeys which are kept as pets.



HANDS AND FEET OF APES AND MONKEYS.

1, 2, Gorilla; 3-8, Chimpanzee; 9, 10, Orang; 11, 13, Gibbon; 14, 15, Guereza; 16-18, Macaque;
19, 20, Baboon; 21, 22, Marmoset.

Distribution Most of the Primates are animals essentially adapted for living in warm climates, and are never found in regions which have not at least a hot summer. Some of them are, however, capable of withstanding a considerable amount of winter cold; and it is no uncommon sight in the outer ranges of the Himalayas to see troops of monkeys leaping from bough to bough of the snow-laden pines. Moreover, two species of monkeys inhabit the elevated regions of Eastern Tibet, where at least part of the winter must be intensely cold. With the exception of the apes found on the Rock of Gibraltar, which must either have reached their present habitation when Spain was united by land with Africa, or have been introduced by man at a later period, none of the Primates are found in Europe; they occur, however, throughout the warmer regions of the remainder of the globe, with the exception of the Australian region; but whereas all the apes and monkeys of the Old World belong to two well-marked families, those of the New World represent two other families closely allied to one another, but markedly different from both those of the Old World. The lemurs, as we shall see later on, are without exception Old World forms, and are especially characteristic of Madagascar, although also represented in India and on the continent of Africa, as well as in certain islands. In past times, however, lemurs were distributed over the greater part of the globe; and monkeys even roamed over the ancient forest-lands of Essex, as is proved by the discovery of a single tooth in the brick earth of Ilford in Essex; and they were also abundant over the more southern regions of Europe.

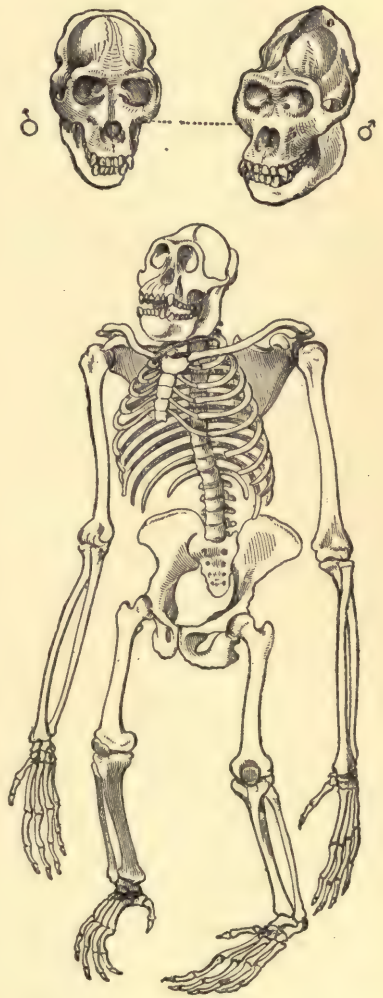
Nearly the whole of the Primates are adapted for a more or less completely arboreal life, most of them being inhabitants of forest regions. Aided by their hand-like feet, all of them are expert climbers, and many, like the Oriental gibbons and the South American spider-monkeys, but rarely leave the trees, leaping from bough to bough, and thus from tree to tree, far above the heads of the travelers below, to whom their presence is made known only by their continual howling or chattering. The climbing powers of the South American monkeys are largely aided by their prehensile tails, which serve the purpose of a fifth limb. Owing to the warmth of the regions in which most of them dwell, no monkeys ever hibernate. Contrary, however, to what is often supposed to be the case, several of the smaller species are expert swimmers, and will fearlessly cross comparatively large rivers.

Characteristics It is now time to take a glance at some of the more characteristic features which distinguish the order as a whole from other Mammals. In the first place, both the hand and the foot are, as a rule, provided with five digits, although in a few instances the thumb is wanting. Then, again, the hand is always adapted to act as a grasping organ, and, with the single exception of man, the same is the case with the foot, though it has recently been discovered that the foot of the newly-born human infant displays distinct traces of having been originally a grasping organ. In those cases where the hand attains its most perfect development, the thumb can be opposed to the fingers, but in some of the lower forms this action is only possible in a limited degree. The great toe is, in a similar manner, opposable to the other toes, although in man, as is well shown in our figure of his skeleton, this action has been lost, and the bones of this toe lie parallel to

those of the other toes. In this respect, as the figure shows, the foot of man is markedly different from that of the gorilla and the other apes. With the curious exception of the orang, in which the great toe is often entirely devoid of any trace of such appendage, all the fingers are furnished with nails. In the higher forms these nails are of a flattened shape in all the digits; and this flatness is always characteristic of the nail of the great toe, although the other digits of the lower forms have curved nails. In order to form an efficient support for these nails, the bones of the terminal joints of the digits, with the exception of the index finger of the lemurs, are transversely flattened out; and are thus very different from those of the Rodents and Carnivores. That the hand and foot should have perfect freedom of motion, it is of course necessary that the bones of the fore-arm and lower leg should remain completely separate from one another; and, as we see from the figured skeletons, the radius and ulna in the fore-arm, and the tibia and fibula in the leg, are both equally well developed and capable of motion upon one another. Another important point as regards the free use of the arms is the presence of complete collar-bones, which are always well developed in apes and monkeys, as they are in ourselves.

If we look once more at the figures of the skeletons of man and the gorilla we shall not fail to observe that in the skull the sockets, or orbits, of the eyes are completely surrounded by a ring of bone, and that the sockets themselves look almost directly forwards. This complete bony ring round the eye-sockets at once serves to distinguish the skulls of all the Primates from those of most of the Carnivores.

In correlation with the herbivorous habits of the majority of the species, the teeth of the Primates are adapted for grinding; the cheek-teeth having broad flattened crowns, which may either, as in ourselves, be surmounted by tubercles, or by transverse ridges. Except in one family of American monkeys, there are always three molar teeth in each side of either jaw, the last of which corresponds with our own "wisdom-tooth"; and these molar teeth are invariably larger and more complicated than the premolars. Very generally, as in ourselves, the number of the latter teeth is reduced to two on each side, and



SKELETON OF THE GORILLA.

no living member of the order has more than three of these teeth. Very frequently again, and indeed invariably in the apes and monkeys, there are but two incisor teeth on each side of both the upper and the lower jaws.

With the single exception of the curious aye-aye of Madagascar, there are at least two mammae situated on the breast of the females of all members of the order.

These, then, are the chief common characters possessed by apes and monkeys on the one hand and lemurs on the other; but, such as they are, they are considered of sufficient importance by a considerable number of zoologists to justify the inclusion of both groups in a single order. The two groups constitute, however, separate suborders, of which the first is termed the *Anthropoidea*, and the second the *Lemuroidea*. We shall point out how the latter group is distinguished from the former when we come to the consideration of the lemurs themselves; and we accordingly now proceed to consider the first family of the Apes and Monkeys.

The Man-like Apes The Man-like Apes are but few in number, and are also those which come nearest, in point of structure, to man himself. Considered, indeed, from a purely zoological point of view, man represents merely a separate family—*Hominidæ*—of the Primates, which should occupy the place of honor at the head of all the other Mammals. Since, however, the special sciences, anthropology and ethnology, are devoted solely to the history of man, we shall here content ourselves by incidentally mentioning a few of the structural features by which he is distinguished from the Man-like Apes.

Apart, then, from man himself, the Man-like Apes include the largest representatives of the Primates. They are exclusively restricted to the Old World, where they are found only in the dense forests of the warmest and dampest regions. They are all characterized by their strikingly human-like form, although none of them habitually walk solely on their hind-limbs without obtaining additional support from their long arms.

Resemblance to Man In all the larger species the resemblance to man is more marked in the young than in the adult; while in the adult the human characteristics are more pronounced in the female than the male. Dr. Robert Hartmann, of Berlin, who has devoted much attention to the Man-like Apes, observes that "in the gorilla, the chimpanzee, and the orang-outang, the external form is subject to essential modifications, according to the age and sex. The difference between the sexes is most strongly marked in the gorilla, and these differences are least apparent in the gibbons. When a young male gorilla is compared with an aged animal of the same species we are almost tempted to believe that we have to do with two entirely different creatures. While the young male still displays an evident approximation to the human structure, and develops in its bodily habits the same qualities which generally characterize the short-tailed apes of the Old World, with the exception of the baboon, the aged male is otherwise formed. In the latter case the points of resemblance to the human type are far fewer; the aged animal has become a gigantic ape, retaining indeed, in the structure of his hands and feet, the characteristics of the Primates, while the protruding head is something between the muzzle of the baboon, the bear, and the boar. Simultaneously with these remarkable alterations of the external structure there

occurs a modification of the skeleton. The skull of an aged male gorilla becomes more projecting at the muzzle, and the canine teeth have almost attained the length of those of lions and tigers. On the upper part of the skull, which is rounded in youth, great bony crests are developed on the crown of the head and on the occiput. . . . The arches above the eye-sockets are covered with wrinkled skin, and the already savage and indeed revolting appearance of the old gorilla is thereby increased."

Teeth In all the Man-like Apes the number of the teeth is the same as in man himself—that is to say, there are on each side of both the upper and lower jaws two incisors, one canine, two premolars, and three molars; the formula thus being: $i\frac{2}{2}$, $c\frac{1}{1}$, $p\frac{2}{2}$, $m\frac{3}{3}$, making a total of 32 teeth. Not only do the teeth agree in number with those of man, but, with the exception of the great size of the tusks, or canines, of the males, they likewise resemble them in structure. We are familiar with the form of our own molar teeth, which have wide crowns, with their angles rounded off and surmounted by four main tubercles set somewhat obliquely to one another; and the molars of the Man-like Apes are of the same general type of structure. In the apes, however, the whole series of teeth does not present the horse-shoe-like contour which is so characteristic of our own teeth; but, on the contrary, the cheek-teeth form nearly straight lines, having an angulated junction with the curved line of the front teeth.

Other None of these apes possess the peculiar pouches in the cheeks
Character- occurring in many of the monkeys, and none of them have any trace
istics of a tail. Moreover, the naked patches so often found on the buttocks of the other Primates are either absent or, if present, are of very small size. All of these animals agree, however, with the monkeys, and thereby differ from man in the great length of the arms as compared with that of the legs; this difference being very clearly indicated in our figures of the skeleton of man and the gorilla. Another characteristic of the Man-like Apes shown in the figures last referred to is the great breadth and flatness of the breastbone or sternum, this being a feature in which they agree with man, and differ from baboons and monkeys. Then, again, some of the Man-like Apes differ from the latter and resemble man in the absence of a small bone occupying a central position in the wrist, and hence known as the centrale of the carpus.

In addition to the points already mentioned, man is distinguished from the Man-like Apes by the greater relative size of his brain and the portion of the skull in which it is contained, as compared with the face and muzzle. His canine teeth are, moreover, but little longer than the other teeth, and are thus quite unlike the huge tusks of the male gorilla and orang. The great toe is also relatively longer, and is, at the most, only opposable in a very limited degree to the other toes. Moreover, the whole skeleton of man, as will be seen from our figure, is of a lighter and neater build, with certain peculiar curvatures of the lower part of the backbone, which permit of the assumption of the perfectly upright position without fatigue, and without need of any support from the arms, which do not reach below the middle of the thigh. Again, no ape has an ear modeled on the beautiful lines of that of the human species. The naked body of man is not, however, a character

which a zoologist would consider of any importance as distinguishing him from the apes.

From their evident structural resemblance to man, the apes and monkeys are rightly placed at the head of the Mammalian class. This must not, however, by any means be taken to imply that all, or even any, of these animals are necessarily higher than the members of all the others. Although the intellect of the Man-like Apes may, and probably does, in some respects, exceed that of a dog; yet, for its own peculiar line of life, a dog is as fully and highly organized as an ape. Then, again, the lower monkeys and all the lemurs are far inferior in intelligence to the higher Carnivores, and indeed to the more highly-developed members of some of the other groups; but this is, of course, no bar to their being included in the order which heads the list.

With these remarks on the Man-like Apes in general, we proceed to the consideration of the various genera and species which comprise the family.

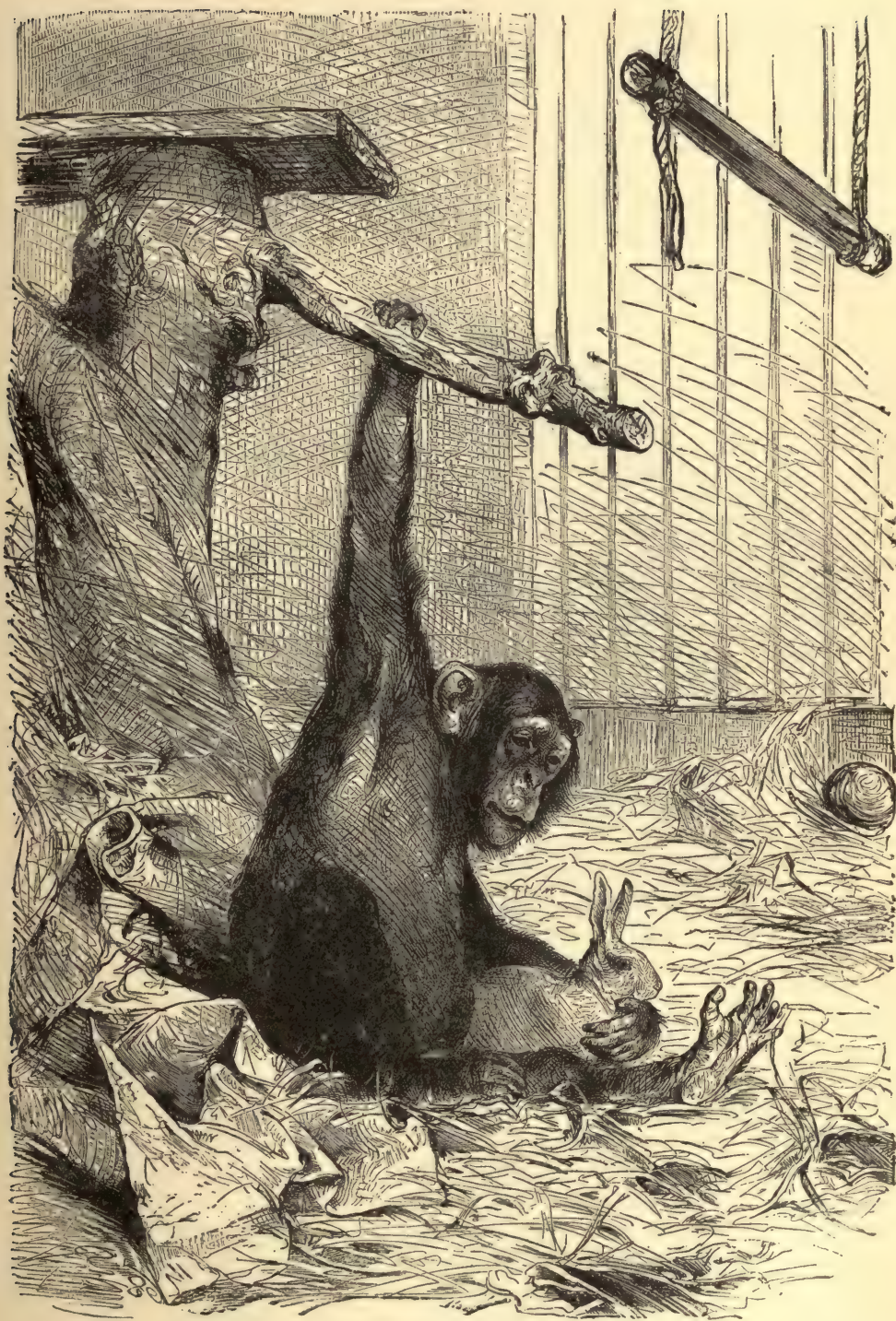
THE CHIMPANZEE

Genus *Anthropopithecus*

Of all the large Man-like Apes, those which, on the whole, make the nearest approach in bodily structure to man are the chimpanzees of Western and Central Equatorial Africa, of which there appear to be two distinct species, one known as *A. niger* the other as *A. calvus*.

The chimpanzee has been long known in Europe. It has, indeed, been considered that the so-called "gorillas," met with by the Carthaginians of Hanno's voyage round the Cape in B.C. 470, on the rocky coasts of Sherboro Island, off Sierra Leone, were chimpanzees. According, however, to Mr. Winwood Reade, who traveled in Western Africa for the express purpose of obtaining authentic information about the chimpanzee and the gorilla, the creatures seen and captured by Hanno's party were neither gorillas nor chimpanzees, but dog-faced baboons. Be this as it may, that the chimpanzee was known in Europe as far back as 1598 is proved by an account brought back from the Congo by a Portuguese sailor, named Eduardo Lopez, and published at Frankfort by Pigafetta in his account of the Congo district. In 1613 there appeared, in Purchas's *Pilgrimages of the World*, the history of the wanderings of an English sailor, named Andrew Battel, in the lower part of Guinea, in 1590, who appears to have heard of or seen, not only the chimpanzee, which he designates the Enjocko (a corruption of N'djeko or N'Schego), but likewise the gorilla, which he calls the pongo.

Battel's account may be quoted at length, as follows. He states: "There are two kinds of monsters common to the woods of Angola; the largest of them is called Pongo in their language, and the other Enjocko. The pongo is in all its proportions like a man (except the legs, which have no calves), but he is of gigantic height. The face, hands, and ears of these animals are without hair; their bodies are covered, but not very thickly, with hair of a dunnish color. When they walk



A YOUNG CHIMPANZEE.

on the ground, it is upright, with the hands on the nape of the neck. They sleep on trees, and make a covering over their heads to shelter them from the rain. They eat no flesh, but feed on nuts and other fruits; nor have they any understanding beyond instinct. When the people of the country travel through the woods they make fires in the night, and in the morning when they are gone the pongos will come and sit round it till it goes out, for they do not possess sagacity enough to lay on more wood. They go in bodies to kill many negroes who travel in the wood. When elephants happen to come and feed where they are, they will fall on them, and



HEAD OF CHIMPANZEE.

so beat them with their clubbed fists and sticks, that they are forced to run away roaring. The grown pongos are never taken alive, owing to their strength, which is so great that ten men cannot hold one of them. The young hang upon their mother's belly with their hands clasped about her. Many of them are taken by shooting the mothers with poisoned arrows."

From that date our knowledge of these animals has been gradually added to, although there is still room for fuller authentic accounts of their habits in a state of nature. Young chimpanzees have been frequently brought alive to Europe, and exhibited in the Zoological Gardens of this and other countries. They require, however, the greatest care and attention, and even with these they invariably die

after a few years or months from the effects of our climate, which generally show themselves in various organic affections, although not, as has been supposed, in the form of tubercular disease of the lungs.

Structure In all points of their structure the chimpanzees are very closely related to the gorilla, although the latter is now generally referred to a separate genus. Originally the chimpanzees were described under the name of *Trogloodytes*; but since that name has been applied at an earlier date to the wrens, it has now been superseded by the somewhat cumbrous, although appropriate name of *Anthropopithecus*. This change is, however, not to be regretted on other grounds, since, as the name *Trogloodytes* means a dweller in caves, while chimpanzees are purely forest animals, it is highly inappropriate to them.

In addition to certain distinctive features in the teeth, such as the relatively small size of the tusks or canines of the males, and the circumstance that the upper "wisdom-tooth" is smaller than either of the two molars in advance of it, chimpanzees may be readily distinguished from the gorilla by the circumstance that the males are but very slightly larger than the females. Moreover, the skull of the male chimpanzee is characterized by the absence of the enormous bony ridges which overhang the sockets of the eyes in that of the gorilla; while in the lower jaw the length of the bony union between the two lateral branches is much less than in the latter. In both these respects the chimpanzee is decidedly nearer to man than is the gorilla; and a further approximation to the human type is presented by the relatively shorter arms, which in the perfectly upright posture only reach a short distance below the knee. The hands and feet also are longer and more slender than those of the gorilla, as may be seen by comparing Figs. 3-8 with 1 and 2 of the illustration on p. 15. Moreover, as in man, the middle finger is longer than either of the others; and although there is some degree of variation in the relative length of the thumb in different individuals, as a rule this digit reaches to the base of the first phalangeal joint of the index finger. The male chimpanzee does not appear to exceed five feet in height when full grown, and is thus considerably inferior in size to the male gorilla.

General Character Dr. Hartmann remarks of the chimpanzees that, although the arched ridges above the eyes "are not so excessively prominent as in a gorilla of the same age, they are strongly developed, covered with wrinkled skin, and in this case also there is a species of eyebrow, stiff and bristly, with shorter hairs between. The large, wrinkled lids are furnished with thick eyelashes. A general physiognomical distinction between the gorilla and the chimpanzee consists in the fact that the bridge of the nose is shorter in the latter than in the former. In the chimpanzee this part of the organ is depressed, yet the depression is of a conical and convex form, and is covered with a network of wrinkles of varying depth. In the chimpanzee the interval between the inner angle of the eye and the upper lateral contour of the cartilaginous end of the nose is shorter than in the gorilla. There is also some difference in the form of the nose; it is on the whole flatter, the tip is less apparent, and the nostrils are not so widely opened, nor so thickly padded. The external ear of the chimpanzee has, on the whole, less resemblance to the human ear, and its contour is larger than that of the gorilla. But this organ varies so

much in individuals that it is difficult to lay down any rule for its average size. The skin of the chimpanzee is frequently of a light, yet muddy flesh color, which sometimes verges upon brown. Spots, varying in size and depth of color, sometimes isolated, sometimes in groups, and of a blackish-brown, sooty, or bluish-black tint, are found on different parts of the body of many individuals, especially on the face, neck, breast, belly, arms and hands, thighs and shanks, and more rarely on the back. The face, which, soon after birth, is of a flesh color, merging into yellowish-brown, assumes a darker shade with the gradual development of the body. The hairy coat is sleek, or only in rare cases slightly curled, and the coarser and bristly hair is generally stiff and elastic. The parting on the forehead is often so regular that it might have been arranged by the hairdresser's art. Close behind that part of the head at which the projecting ridges over the eyes of the gorilla generally meet there is in the chimpanzee (as is well shown in our figure of the head) an altogether bald place, or often only a few scattered hairs. Round the face the growth of hair streams downward like a beard. On the neck it is of considerable length, and it falls in the same long locks over the shoulders, back, and hips. The hair on the limbs is not so long, and takes a downward direction on the upper arm, and an opposite direction on the fore-arm, while there is often a longitudinal parting on the centre of the inner surface of this part of the limb. On the back of the wrist the hair grows in a kind of whorl; the upper hairs turn upwards and backwards, the middle ones turn backwards, the lower ones backwards and downwards. The backs of the hands and the roots of the fingers are hairy. On the front of the thigh the hair takes a downward direction, while behind it grows backwards. On the shank it grows downwards in the region of the tibia, and turns back on the inside of the leg. The back of the foot and the roots of the toes are likewise hairy. There is a shorter growth of these hairs on the face, chin, and ears. In other cases the hair of the true chimpanzee is of a black color. Short whitish hairs may be observed on the lower part of the face and chin, as well as round the posterior; and sometimes the color of the hair is shot throughout with reddish- or brownish-black."

The foregoing description applies to the true chimpanzee, *Anthropopithecus niger*. Many varieties of this species seem to exist, some of which have been regarded as distinct species; but with the exception of the bald chimpanzee, to be mentioned immediately, it does not appear that any of these can be satisfactorily distinguished as true species. The natives of Africa have many names for chimpanzees in the various districts. In the Gabun region they are known as N'Schego, in Malimbu as Kulu, in Manyema as Soko, and in the Niam-Niam district as Ranja; while to the Arab traders they are known as the Bam or M'Bam.

The Bald Chimpanzee In his *Equatorial Africa* Du Chaillu gave a description of a chimpanzee, which he said was known to the natives as the N'Schego M'Bouvé, and which he proposed to call *Trogodytes*, or as it should properly be, *Anthropopithecus calvus*. For a long period zoologists were in doubt whether this bald-headed chimpanzee was really a distinct species. In the autumn of 1883 a young chimpanzee was, however, purchased by the Zoological Society of London, which Mr. Bartlett, the superintendent of the Society's Gardens, recognized as being very

different from the true or common chimpanzee, and which he regarded as in all probability identical with Du Chaillu's bald chimpanzee.

Writing of this animal, Mr. Bartlett remarks that, while "the color of the face, hands, and feet in the chimpanzee are white or pale flesh color, the same parts of the animal under consideration are black or brownish-black. Another well-marked difference is to be found in the hair upon the head and face. In the true chimpanzee the hair on the top of the head, and that passing down from the centre (where it divides) to the sides of the face or cheeks, is tolerably long and full, forming what may be considered rather bushy whiskers; whereas the figure (given in the memoir), clearly shows the front, top, and sides of the head and face to be nearly naked, having only a few short hairs on the head, quite destitute of any signs of the parting so very conspicuous in the chimpanzee. Another striking difference may be noticed in the size and form of the head and ears. Out of the number of chimpanzees I have seen and examined, both old and young, none have possessed the large flat ears so conspicuous in this individual. The form of the head, the expression of the face, the expanded nostrils, the thicker lips, especially the lower lip, together with the more elevated skull, cannot fail to distinguish this animal from the chimpanzee. . . . Again, the habits of this animal differ entirely from those of the well-known or common chimpanzee. She has always shown a disposition to live upon animal food. Soon after her arrival I found she would kill and eat small birds; seizing them by the neck, she would bite off the head and eat the bird, skin, feathers, and all; for some months she killed and ate a small pigeon every night. After a time we supplied her with cooked mutton and beef tea; upon this food she has done well. I have never found any ordinary chimpanzee that would eat any kind of flesh.

"Another singular habit was the producing pellets or 'quids,' resembling the castings thrown up by raptorial birds. They are composed of feathers and other indigestible substances, that had been taken with her food. Moreover, she is an expert rat-catcher, and has caught and killed many rats that had entered her cage during the night. Her intelligence is far above that of the ordinary chimpanzee. With but little trouble she can be taught to do many things that require the exercise of considerable thought and understanding; she recognizes those who have made her acquaintance, and pays marked attention to men of color, by uttering a loud cry of *bun, bun, bun*. She is never tired of romping and playing, and is generally in a good temper."

We shall have something to say in regard to the mental faculties of this chimpanzee later on, but we have now to consider, firstly, the geographical distribution of chimpanzees, and then their mode of life and habits.

Distribution As already mentioned, chimpanzees inhabit Western and Central

Equatorial Africa, where they range over a considerable area of country. On the west coast their range appears to be limited to the northward approximately by the river Gambia, while their southward range extends about to the river Coanza, which flows into the ocean at the boundary between Angola and Benguela. Their limits on either side of the Equator do not, therefore, exceed some twelve degrees, the northern range in latitude being greater than the southern. With regard to the extent of their range across the continent to the eastward,

chimpanzees are known to occur to the northwest of the great lakes in the Niam-Niam district, in 28° east longitude, and they are likewise recorded from Monbottu. Dr. Emin Pasha, writing to the secretary of the Zoological Society of London, considers, however, that they range to about the parallel of 32° east longitude. Dr. Emin's letter states, "It may be interesting for you to hear that an anthropoid ape exists in Uganda and Unyoro (the districts lying between the Victoria and the Albert Nyanza). I cannot say whether it is identical with the Monbottu chimpanzee or not. While staying in these countries the negroes told me much about this animal, and in a manuscript map which I forwarded to Dr. Petermann, I fixed its northern limit at 2° north latitude. Now I hear that this ape is frequent in the thick forests near Ugoma, and I hasten to beg my friend King Kabrega for some specimens." If this application to the king ever reached him it does not appear to have been successful. Later on, however, Dr. Emin forwarded to England the skull of a chimpanzee shot by himself near Lake Albert Nyanza, which does not appear to differ from that of the West African form.

Habits

Like all the other Man-like Apes the chimpanzees are forest-dwelling animals, although on the coast of the Loango district they are found in the mountains. Their food is usually the various wild fruits which grow abundantly in these dense forests, but, as we have seen, at least the bald-headed species will take kindly to an animal diet in captivity.

The following account of the habits of the chimpanzee is taken from Dr. Hartmann, who draws much of his information from the German traveler, Schweinfurth, as detailed in his work entitled *From the Heart of Africa*. Dr. Hartmann observes that the chimpanzee either lives in separate families or in small groups of families. "In many districts—as, for example, in the forest regions of Central Africa—its habits are even more arboreal than are those of the gorilla. Elsewhere as, for instance, on the southwest coast, it seems to live more upon the ground. The Bam chimpanzee of Niam-Niam inhabits the galleries, as they were called by Piaggia and Schweinfurth—that is, the forest trees growing one above another in stages, of which the growth is so dense that it is difficult to get at them. The powerful stems, thickly overgrown with wild pepper, have branches from which hang long streamers of bearded moss, and also a parasitic growth of that remarkable fern to which Schweinfurth gave the name of elephant's ear. The large tun-shaped structures of the tree termites (white ants) are found on the loftier boughs. Other stems, rotten and decayed, serve as supports for the colossal streamers of *Mucuna urens* (a climbing leguminous plant with yellow or white flowers and large leathery seed-pods), and form bowers overhung with impenetrable festoons, as large as houses, in which perpetual darkness reigns.

"When the chimpanzee goes on all fours, he generally supports himself on the backs of his closed fingers (compare Fig. 6 of the illustration on p. 15) rather than on the palm of the hand, and he goes sometimes on the soles of his feet, sometimes on his closed toes. His gait also is weak and vacillating, and he can stand upright on his feet for a still shorter time than the gorilla. At the same time he seeks support for his hands, or clasps them above his head, which is a little thrown back in order to maintain his balance."

Chimpanzees appear to be continually shifting their haunts in order to find fresh feeding grounds, and will not unfrequently visit and pillage deserted native plantations. They utter loud cries, which may be heard resounding through the forests at all hours of both day and night. Dr. E. Pechuel-Loesche, who accompanied the expedition sent to Western Equatorial Africa during the years from 1873 to 1875, observes that chimpanzees "are really accomplished in the art of bringing forth these unpleasant sounds, which may be heard at a great distance, and are reproduced by the echoes. It is impossible to estimate the number of those who take part in the horrid noise, but we often seemed to hear more than a



THE CHIMPANZEE "MAFUKA."

hundred. They generally remain upon the ground among the dense underwood and thickets of *Amomum* (a member of the ginger family) and other scitamineous plants, and only climb trees for the sake of obtaining fruit. Their track may be plainly discerned on soft ground; they stop short wherever the *Amomum* grows, of which they are very fond, and the red husks of the fruit of which may be seen strewn around."

There seems to be no doubt but that chimpanzees build a kind of nest high up in the trees for their families; and it is stated that the male of the family takes up his position for the night beneath the shelter afforded by the nest. It is probable that this habit has given rise to the idea that these animals construct penthouses

for themselves; an elaborate illustration of such a structure being given in Du Chaillu's *Equatorial Africa*.

It is said that chimpanzees will generally take to flight at the sight of man, but that when driven to bay, or their retreat cut off, they will attack him fiercely, and are then very awkward customers with which to deal. Dr. Livingstone, in his *Last Journals*, gave an account and sketch of a chimpanzee hunt by the Manyema tribe, describing these animals under their name of Soko, but apparently confusing them with the gorilla. The doctor's graphic sketch shows four chimpanzees surrounded by natives, one of the former having received its death wound, a second with a spear in its back, and a fourth making a vigorous onslaught on one of the hunters, whose hand it has seized in its mouth. Dr. Livingstone states that the chimpanzee "kills the leopard occasionally, by seizing both paws and biting them, so as to disable them; he then goes up a tree, groans over his wounds, and sometimes recovers, while the leopard dies. The lion kills him at once, and sometimes tears his limbs off, but does not eat him. The soko eats no flesh; small bananas are his dainties, but not maize. His food consists of wild fruits, and of these one is large, a large sweet sop but indifferent in taste. The soko brings forth at times twins."

In captivity chimpanzees, when in health, are gentle, intelligent, and affectionate, readily learning to feed themselves with a spoon, or to drink out of a glass or cup. Unfortunately, however, their span of life in this country is but brief. The longest period that a chimpanzee has hitherto lived in the Zoological Society's Gardens is eight years; "Sally," who died in 1891, having been kept there for that time.

One of the earliest accounts of the chimpanzee in captivity was given by the late Mr. Broderip, and is to be found quoted in most works on Natural History. It relates to a young male brought from the Gambia in the year 1835, which was deposited in the menagerie of the London Zoological Society. Dr. Hartmann has also published an interesting description of the habits of another male, which was exhibited in the Berlin Aquarium in 1876, and was remarkable for its unusually lively and cheerful disposition.

More recent, and thus probably less widely known, is, however, the description by Dr. J. G. Romanes of the mental power of the bald chimpanzee, "Sally," already mentioned as having lived so long in London. This account was written in 1889, after the creature had been nearly six years in the Zoological Gardens. The intelligence of "Sally" is compared by Dr. Romanes to that of a child a few months before emerging from the period of infancy, and is thus far higher than that of any other Mammal (exclusive of man). In spite, however, of this relatively high degree of intelligence, the creature's power of making vocal replies to her keepers, or those with whom she was brought into contact, were of the most limited kind. Such replies were, indeed, restricted to three peculiar grunting noises. One of these indicated assent or affirmation; another, of very similar intonation, denoted refusal or distrust; while the third, and totally different intonation, was used to express thanks or recognition of favors. In disposition "Sally" was, like many of her sex, apt to be capricious and un-

certain ; although, on the whole, she was good-humored and fond of her keepers, with whom she was never tired of a kind of bantering play, which was kept up at intervals almost continually. By singing in a peculiar kind of monotone, in imitation of her own utterance, her keepers were usually able to induce her to go through a series of remarkable actions, the meaning of which is not very apparent.



THE CHIMPANZEE "SALLY."

First she would shoot out her lips into a tubular form, uttering at the same time a weird kind of howling note, interrupted at regular intervals. The pauses would, however, gradually become shorter and shorter, while the sing-song cry became louder and louder, until it finally culminated in a series of yells and screams, not unfrequently accompanied with a stamping of the feet, and a violent shaking of the

netting of her cage. After this climax the utterance of a few grunts terminated the performance.

Some time previous to 1889, it occurred to Dr. Romanes (from whose account we are paraphrasing) that "Sally" would be a good subject to test the power of the simian intelligence by a series of special experiments. It was found, however, that such experiments were seriously hampered by the effects on the creature of the visits of the numbers of people who were constantly passing in and out of the room in which she was kept; and there is consequently but little doubt that, under more favorable circumstances, the results obtained would have been more remarkable than they are. Dr. Romanes, having secured the assistance of the keepers, caused them to ask "Sally" repeatedly for one, two, or three straws, which she was to pick up and hold out from among the litter strewn in her cage. The number of straws asked for was constantly varied, and never followed by any regular order; and when the correct number was presented the animal was rewarded by a piece of fruit, while if the number was incorrect her offer was refused. "In this way," observes Dr. Romanes,* "the ape was taught to associate these three numbers with their names. Lastly, if two or three straws were demanded, she was taught to hold one or two in her mouth until she had picked up the remaining straw, and then to hand the two or three straws together. This prevented any error arising from her interpretation of vocal tones. As soon as the animal understood what was required, and had learned to associate these three numbers with their names, she never failed to give the number of straws asked for. Her education was then extended in a similar manner from three to four, and from four to five straws. Here I allowed her education to terminate. But more recently one of the keepers has endeavored to advance her instruction as far as ten. The result, however, is what might have been anticipated. Although she very rarely makes any mistake in handing out one, two, three, four, or five straws, according to the number asked for, and although she is usually accurate in handing out as many as six or seven, when the numbers eight, nine, or ten are named, the result becomes more and more uncertain, so as to be suggestive of guesswork. It is evident, however, that she understands the words seven, eight, nine, and ten to betoken numbers higher than those below them; and if she is asked for any of these numbers, she gives some number that is above six and not more than ten; but there is no such constant accuracy displayed in handing out the exact number named, as is the case below six. On the whole, then, while there is no doubt that this animal can accurately compute any number of straws up to five, beyond five the accuracy of her computation becomes progressively diminished. It is to be noticed that the ape exhibits some idea of multiplication; for she very frequently doubles over a long straw so as to make it appear as two straws. Any of the rare errors which she makes in dealing with numbers below six are almost invariably due to her thus endeavoring to duplicate her straws. In this connection it is to be remembered that, owing to the method above described, when any high number is demanded, a considerable tax is imposed upon her patience; and as her movements are deliberate, while her store of patience is small,

*We have somewhat abbreviated the extract.

it is evident that the doubling of the straws is intended to save trouble by getting the sum completed with greater rapidity. Of course we do not recognize these doubled straws as equivalent to two straws, and therefore the persistency with which she endeavors to palm them off as such is the more noteworthy. Moreover, I am disposed to think that the uncertainty which attends her dealing with the numbers six and seven is more due to her losing patience than to her losing count; although after seven I believe that her computation of the numbers becomes vague."



HEAD OF CHIMPANZEE "MAFUKA."

Before her death as we have been informed by Dr. Romanes, "Sally" was able to count up to as many as ten straws; and if her life had been prolonged she might even have advanced beyond this. Dr. Romanes proceeds to state that it would be unreasonable to assume that this chimpanzee really employed any system of notation in delivering the correct tale of straws, and we may rather consider that she executed her task by a direct perception of the difference between a higher and lower number, without any actual process of counting; this inference being confirmed by the power possessed by men of simultaneously estimating with accuracy the number of a low series of small objects set before them without any direct enumeration.

In addition to these attempts to determine "Sally's" capacity for numbers, Dr. Romanes instituted a series of experiments designed to test her powers of recognizing and distinguishing between colors. "It appeared to me," says the experimenter, "that if I could once succeed in getting her to know the names of black, white, red, green, or blue, a possible basis might have been laid for further experiments wherein these five colors could have been used as signs of artificially associated ideas. The result, however, of attempting to teach her the names of colors has been so uniformly negative that I am disposed to think the animal must be color-blind. The method adopted in these experiments was to obtain a number



SIDE VIEW OF HEAD OF CHIMPANZEE "MAFUKA."

of brightly and uniformly colored pieces of straw—each piece being either white, black, red, green, or blue. Offered the straws two by two of different colors on each occasion, the ape was invited to select the straw of the color named from the one whose color was not named, and, of course, on choosing correctly was rewarded with a piece of fruit. In this way she quickly learned to distinguish between the white straws and the straws of any other color; but she never could be taught to go further. Now the distinction between the white straws and the straws of any other color is a distinction which can be drawn by an eye that is color-blind; and from the fact that the ape is always able to perceive this distinction, while she

cannot be taught to distinguish any of the others, I conclude that her failure in this respect is not due to any want of intelligence, but to some deficiency in her powers of color perception."

Mafuka We must conclude our notice of chimpanzees by the mention of a very remarkable ape which was brought from the Loango Coast in 1875, and exhibited in the Zoological Gardens at Dresden. This animal was a female, and from its peculiar physiognomy, as shown in our two figures of its head, has given rise to much discussion as to what species it really belonged. The creature was of a fierce disposition, and was generally known by the name of Mafuka. Although presenting many of the features of a chimpanzee, it had very projecting jaws, the ears were relatively small and placed rather high on the head, while the end of the nose was wide and expanded. The most remarkable feature about this animal was, however, the presence of a great bony ridge overhanging the eyes, very much as in the female gorilla. So like, indeed, was Mafuka to a gorilla in this respect, that Dr. Hartmann tells us when he first saw her he felt almost convinced that he had to do with a female gorilla which had not quite attained maturity. This opinion was, however, vigorously confuted by other zoologists; and it was subsequently suggested that the creature might be a half-breed between the chimpanzee and gorilla. Dr. Hartmann concludes by saying that "for me and many other naturalists Mafuka remains up to this time an enigma." Unless, which is very improbable, this animal indicates a third species of chimpanzee, we confess that the half-breed theory appears to us the most probable solution of the mystery.

Extinct Chim-panzee A word in regard to a fossil-ape found in the northwest of India in rocks, belonging to the Pliocene or later division of the Tertiary period, and we have done with chimpanzees. It has always been a matter of surprise that no large Man-like Ape now inhabits the dense tropical forests of India or Burma, which would appear to be just as suitable for these creatures as are those of Borneo or Equatorial Africa. The discovery in India of a jaw of a large ape apparently belonging to the same genus as the chimpanzee shows us, however, that large Man-like Apes must have once roamed over the plains of India. Why chimpanzees, together with hippopotami and giraffes, which are likewise found fossil in India but are now confined to Africa, should have totally disappeared from the former country, is, however, one of those puzzling problems connected with the distribution of animals which we have but little hope of answering satisfactorily.

The fossil Indian chimpanzee was found in the arid districts of the Punjab, and since we know that the living Man-like Apes dwell in the deepest gloom and solitude of primeval forests, where vegetation grows luxuriously and offers a constant supply of fruits throughout the year, we may probably infer that the Indian chimpanzee inhabited a similar forest-clad country; and that, consequently, the present area of the Punjab was in parts at all events clothed with forests in which dwelt this ape, instead of being, as now, a sun-scorched and somewhat desolate region. Evidence of the former existence of these forests is afforded by the occurrence of numbers of fossil tree-stems in various parts of the same series of rocks from which the remains of the fossil chimpanzee were obtained.

THE GORILLA

Genus *Gorilla*

Under the heading of the Chimpanzee we have already seen how, as far back as 1590, the English sailor Battel heard of the existence of a gigantic ape living in the forests of Guinea, and known to the natives as the Pongo; this ape being also known under the names of Jina, N'Jina, or Indjina, or N'Guyala, while by Europeans it is universally termed the Gorilla. The naturalist Buffon appears to have given credence to Battel's Pongo (N'Pungu, or M'Pungu, as it is variously spelled); but his account was summarily rejected by the great Cuvier as a mere traveler's tale. Still, however, vague rumors of the existence on the West Coast of Africa of an ape of larger size and fiercer habits than the chimpanzee from time to time reached Europe; and in 1819 Bowdich, in his account of the "Mission from Cape Coast Castle to Ashanti," definitely stated that among the many curious apes found in the Gabun district the ingenu (or gorilla) was by far the largest and strongest. It was not, however, till the year 1847 that any precise evidence of the existence of this mysterious ape reached Europe. In that year, however, Dr. Savage, an English missionary stationed at the Gabun, wrote to the veteran comparative anatomist, Sir Richard Owen, enclosing drawings of the skull of an ape from that district, which was described as being much larger than the chimpanzee, and feared by the negroes more than they dread the lion, or any other wild beast of the forest. These sketches clearly showed the bold bony crests over the eye sockets, which mark the skull of the gorilla as distinct from that of the chimpanzee. "At a later date in the same year," writes Sir Richard Owen, "were transmitted to me from Bristol two skulls of the same large species of chimpanzee as that notified in Dr. Savage's letter; they were obtained from the same locality in Africa, and brought clearly to light evidence of the existence in Africa of a second larger and more powerful ape." In the following year these specimens were described by the English anatomist under the name of *Troglodytes savagei*. It appears, however, that about the same time that Dr. Savage forwarded the sketches to Sir Richard Owen, he also sent a skull of the unknown ape, together with a description of the animal itself, by the hand of a fellow-missionary named Wilson, to Boston in the United States. And in an American scientific journal for the year 1847, the new ape was described, and named *Troglodytes gorilla*. Thus matters stood till the year 1851, when a Captain Harris presented to the Royal College of Surgeons the first skeleton of a gorilla that had ever been brought to England; while in the same year another skeleton was sent to Philadelphia by Mr. Ford. This at once made a great advance in our knowledge of the creature; and in 1852 a French naturalist came to the conclusion that the gorilla ought not to be included in the same genus as the chimpanzee; and he accordingly proposed for it the name of *Gorilla gena*. By the rules of nomenclature adopted among zoologists, he had, however, no right to supersede the specific name proposed by Sir Richard Owen; and the gorilla is accordingly now known scientifically as *Gorilla savagei*.



THE YOUNG GORILLA AT PLAY.

In 1856 the well-known African traveler, Du Chaillu, arrived at the Gabun, preparatory to his expedition into the interior; and two years later the British Museum received from the Gabun an entire gorilla preserved in spirits, the skin of which was soon afterwards mounted and exhibited to the public.

Such is the history of the gradual acquisition of our knowledge of the largest of the apes. On his return from the Gabun to America, Du Chaillu set to work to publish an account of his travels and adventures; and in 1861 the world was startled by the appearance of his *Explorations and Adventures in Equatorial Africa*, which gave a full and illustrated narrative of numerous personal encounters with gorillas. Somewhat later, an Englishman, Mr. Winwood Reade, made an expedition to the Gabun for the purpose of verifying these accounts; the results of his journey being given in a work entitled *Savage Africa*, of which the first edition appeared in 1863. In this work it is asserted that neither Du Chaillu nor any other European had up to that date ever seen a wild, living gorilla in its native haunts, though he possibly did not refer to those driven to the shore in 1851; and his assertions are supported by the members of the German Loango Expedition of 1873-76. Be this as it may, Du Chaillu's accounts of gorilla-hunting have been so frequently quoted that we need hardly dwell on them here.

We now proceed to describe the gorilla, noticing especially the **Characteristics** more important characters in which it differs from the chimpanzee. In the first place, it may, however, be observed that both these animals agree in the deep black color of their skin, and the blackish hue of a large portion of the hair. One of the most obvious distinctive features of the gorilla, as distinguished from the chimpanzee, is that the males are very much larger than the females, while their skulls have the beetling, bony ridges overhanging the sockets of the eyes, which give to the living animals their peculiarly ferocious and forbidding aspect. Then, again, the arms are relatively longer than in the chimpanzee, reaching, in the upright position, some considerable distance below the knee, although never below the middle of the lower leg or shin. In regard to our figure of the skeleton of the gorilla, given on p. 17, it should, however, be observed that it is taken from one mounted in a somewhat slouching position, so that the hands reach lower down than would have been the case had it been set perfectly upright. Another point in which the gorilla differs from the chimpanzee, and thereby departs still further from the human type, is the greater length of the median bony union of the two branches of the lower jaw. Moreover, the "wisdom-tooth," or last molar, in the upper jaw, is larger than either of the two molars in front of it; this being another departure from the chimpanzee and man.

Such are some of the leading structural features by which the gorilla is distinguished from the chimpanzee, and they are those on which zoologists chiefly rely in referring these animals to different genera. We shall see, however, immediately that there are many other points of difference, but before noticing these we must mention certain characteristics by which the chimpanzee and gorilla are collectively distinguished from the lower Man-like Apes, and thereby agree with man. One of these is that the total number of joints in the backbone, or vertebræ, lying between the solid mass called the sacrum and the neck is seventeen, or the

same as in man. It is true, indeed, that whereas in man only twelve of these vertebræ carry ribs, in the gorilla and chimpanzee thirteen are so provided; but this is a matter of minor import, which is entirely overbalanced by the numerical identity of the vertebræ. The other point is the absence of the central bone in the wrist; so that whereas in man, the chimpanzee, and the gorilla the total number of separate wrist-bones is but nine, in all the other Primates it is ten. This is a very important characteristic in connecting these two apes with man.

Relationship to Man Here we may make a brief digression to explain what zoologists mean by the connection and relationship of these apes with man. A great deal of nonsense has been written about the impossibility of man being descended from the chimpanzee, a gorilla, or an orang. No one, however, who knows what he is talking about, can ever suppose for a single moment that such was the case. What zoologists do contend for is that, supposing some kind of evolution to be the true explanation of the origin of animals,—and all the available evidence indicates that it is so,—man is so intimately connected, so far as his bodily structure is concerned, with the higher apes that, in this respect at least, he cannot but be considered to have had a similar origin. And on this view both man and the Man-like Apes are regarded as diverging branches descended from a common ancestor,—“the missing link,”—long since extinct, and as much unlike any living ape, as such apes are unlike man himself. The gorilla and chimpanzee are presumed to be descended from apes which diverged from the common ancestral stock, subsequently to the assumption of the human attributes of seventeen vertebræ between the sacrum and the neck, and the loss of the central bone in the wrist.

With these few words on this deeply interesting and important subject, we proceed to a more detailed examination of the gorilla.

Structure A full-grown male gorilla, if standing in a perfectly upright position, will generally measure rather more than six feet in height; and since his body is much more bulky, and his limbs are longer than those of a man, he is considerably the largest representative of the Primates. As in the chimpanzee, there are distinct eyebrows on the forehead and lashes to the lids of the eyes. The nose has a relatively long bridge, and its extremity is high, conical, and widely expanded; the whole length being divided by a distant furrow running down the middle line, and becoming more marked as age advances. The upper lip is remarkable for its shortness; and the whole of the dark skin in the region of the nose, cheeks, and mouth is marked by a number of rugose folds. The massive jaws are extremely projecting, and with their huge tusks, or canine teeth, complete the repulsive aspect imparted to the expression by the overhanging eyebrows. The lower jaw has scarcely any indication of the prominent chin which is such a characteristic feature in the human countenance, but it slopes rapidly away from the middle line in front, so as to assume a somewhat triangular contour. The whole skin of the face is of deep black color, of a glossy appearance, and sparsely sprinkled with coarse hairs. The ears are comparatively small, with their hinder border sharply angulated in the middle, and appear to be fastened above and behind to the sides of the face. Like the face and lips, the ears are of a deep black

hue. The head is joined to the trunk by a very short and thick neck, which gives the appearance of its being set into the shoulders; and the term "bull-necked" is therefore strictly applicable to the creature. This great thickness and power of the neck is largely due to the backward projection of the occipital region of the skull, and the tall spines surmounting the vertebræ of the neck. In correlation with the great development of this region, we find the muscles of the shoulders and chest equally powerful, as is essential for the movements of the mighty arms. On the latter the arrangement of the hair is the same as in the chimpanzee; but we notice a great difference in the form of the hands, as may be seen from the illustration on p. 15. Thus, in marked contrast to that of the chimpanzee, the hand (1) is remarkable for its great width and stoutness, coupled with the shortness and generally clumsy make of the fingers, which are united together by a strong web, reaching nearly to the end of their first joints. The thumb is short in proportion to the fingers, reaching but slightly beyond the middle of the metacarpal bone of the index finger, and is nearly conical in shape at its extremity. The fingers, on the contrary, are somewhat flattened, at their extremities. There is but little difference, as seen in our figure, between the lengths of the index, middle, and ring fingers; the former being sometimes as long as, but at others shorter than the middle finger. In all cases, however, the "little" finger is true to its name in being shorter than either of the others. The skin on the back of the wrist is thrown into a number of deep folds, with an oblique direction; while a network of wrinkles covers the backs of the fingers, which have large callosities on the first and sometimes also on the second joints; these callosities being produced by the animal walking, when on all fours, with its fingers doubled on the palms of the hands. On the deep black and naked skin of the palms of the hands, which are hard and horny, there are generally numerous wart-like growths.

With the exception of noticing its enormous bulk, especially in the lower part, we need not devote any particular attention to the body of the gorilla; and we accordingly direct our observation to the hind-limbs or legs. One of the most important features in these is that the calves are more developed than in any of the other Man-like Apes. The foot, as contrasted with that of the chimpanzee in the illustration on p. 15, is characterized by its great breadth and width, and also by the extreme shortness of the very thick toes. The great toe varies somewhat in length, as compared with that of the others, reaching in some individuals as far as the end of their first joints, and in others to the middle of the second. In contrast to the thumb, the great toe is expanded at the end; and, in opposition to the other toes, forms a grasping organ of great power. None of the other toes are as thick as the great toe; the middle toe being slightly longer than either of the adjacent ones, while the little toe is considerably shorter. The sole of the foot is somewhat convex, but its upper surface is very flat, and there is no sort of resemblance to the human instep in the whole foot. The upper surface of the foot, as far as the commencement of the toes, is thickly covered with hair, but on the latter the hairs become thinly scattered; while the sole is bare, and covered with a thick horny skin. Owing to the habit of its sometimes walking with the toes bent under the sole of the foot, the gorilla has callosities on the upper surface of the toes.



GORILLAS AT HOME.

Color With regard to the color of the hair, of which, as we have already said, the general hue is blackish, there is considerable individual variation, and likewise a change attendant upon age; very old gorillas becoming more or less completely grizzled. As a rule, we may notice a reddish-brown tint on the hair at the top of the head, although it may be dark brown, or even black; the hairs generally being differently colored in different portions of their length. On the sides of the face the hair is grayish at the roots and dark at the tips; while on the neck and shoulders it tends to become lighter at the tips. A dark gray color seems to characterize the tips of the hairs over the greater portion of the body and the upper parts of the limbs; but below the tips these hairs have a dark brown ring, beneath which they again become lighter. On the lower parts of the limbs and hands the hairs are darker at their tips, where they vary from brown to black; but in some individuals these portions of the limbs may be covered, like the trunk, with a mixture of gray and brown hairs.

External Covering The hair consists of an outer coat of long stiff bristles, and of a shorter inner coat of fine, short, curly hairs, approximating to a woolly nature. The moderately long hair on the crown of the head is very stiff, and can be erected when the animal is enraged. Although the front and sides of the chin have but a short covering of hair, its under portion has a distinct beard or ruff. By far the longest hair on the upper part of the body is that growing on the shoulders, and hanging down thence on the back and upper part of the arms. The length of this hair is, however, somewhat exceeded by that growing on the thighs. On the chest and the rest of the under parts the hair is much shorter; that on the chest generally taking an upward and outward direction. The woolly under-hair is not very thick, and has no tendency to mat together. The long hair of the shoulders, back, and thighs communicates a generally shaggy appearance to the gorilla, although this is much less marked than in the orang.

Female The female gorilla, as we have already mentioned, is much smaller than the male, and does not generally exceed some four and a half feet in height. The whole build is, moreover, relatively weaker, the tusks are but slightly developed, and the skull is proportionately smaller and more rounded, without the huge bony arches over the eyes. It appears, moreover, that in the adult female the bridge of the nose is relatively shorter than in the male, while the cheeks are wider, and the upper lip longer than is usually the case in the latter. The general appearance of the female gorilla is, therefore, considerably less ferocious and repulsive than that of her lord and master.

Having now made our readers acquainted with the chief characters of the gorilla, we proceed firstly to notice the districts and nature of the country it inhabits, and then to say something as to its mode of life.

Geographical Distribution The geographical range of the gorilla is very much more restricted than is that of the chimpanzee, being limited to that district of Western Equatorial Africa, lying between 2° north latitude and 5° south latitude, and apparently not extending further into the interior than 16° east longitude. This hot and miasmatic region includes the mouths of the rivers Ogavai, Gabun, and Muni, and also the range of mountains running for about a hundred

miles in a northerly direction between the former and the Cameruns, known as the Sierra do Cristal. According to the medical missionary, Mr. H. A. Ford, already alluded to, gorillas are most common in the Sierra do Cristal, and have also been found a day's journey from the mouth of the Muni. During the years 1851 and 1852 numbers of gorillas, probably driven from the interior by want of food, were seen on the coast of the Gabun district, several of which were killed; the specimens sent by Captain Harris to London, and by Mr. Ford to Philadelphia being probably some of these. Subsequently to 1852 they appear never to have been seen on the coast. According to the report of the German Loango Expedition, already alluded to, gorillas are very rare in the Loango district near the coast, but are met with in or near the mountainous region further inland. Writing in 1859, Sir Richard Owen gave the following account of gorilla-land in the district between the Gabun and Muni (or Danger) rivers, which he appears to have derived from the narratives of correspondents residing in these regions. He observes, "The part where the gorilla has been most frequently met with presents a succession of hill and dale, the heights crowned with lofty trees, the valleys covered by coarse grass, with partial scrub or scattered shrubs. Fruit trees of various kinds abound both on the hills and in the valleys; some that are crude and uncared for by the negroes are sought out and eagerly eaten by the gorillas; and as different kinds come to maturity at different seasons, they afford the great denizens of the woods a successive and unfailing supply of those indigenous fruits." The professor then goes on to mention the various trees which have been identified among those which afford food to the gorillas. Among these the most important appears to be the oil palm (*Elais*), of which the part eaten is the undeveloped spathe, known as the palm cabbage; next we have the so-called gray plum tree (*Parinarium excelsum*), bearing a gray somewhat insipid fruit of the size of a large plum. Another is the papaw tree (*Larica*); two kinds of wild plantains (*Musa*); several sorts of *Amomum*, one of which produces the Malacca pepper—a tree bearing a walnut-like fruit, of which the gorilla is said to crack the shell with a stone, and which may be allied to the kind which produces the kola-nut. Lastly, we have a tree which, at the time when Sir R. Owen wrote, had not been identified, but which bears a fruit somewhat resembling a cherry. According to later accounts, gorillas will also visit the plantations of the natives, and do much damage to them.

Mode of Life In regard to the actual mode of life of the gorilla there is a great dearth of authentic information. The old stories that these animals would seize with their foot natives passing beneath the trees on which they dwelt and drag them up, and likewise those to the effect that they gathered round the deserted camp fires of the natives, as well as the legends that they drove off the elephant with clubs, were disposed of once for all by Du Chaillu. Unfortunately, however, we are equally unable to accept his own stories as to the male gorilla coming on to the attack in an upright position, and beating its chest with its fists, since, as we have already mentioned, Mr. Winwood Reade denies that Du Chaillu ever saw a living, wild gorilla. This is supported by the circumstance that all the skins of gorillas purchased by the British Museum from Du Chaillu show that their owners were killed by a wound in the back from the weighted spears which

the natives are accustomed to suspend in the paths of these animals. The members of the German Loango Expedition frankly confess that they never saw a living, wild gorilla, although they brought home a young one which had been captured by some native hunters; neither did Winwood Reade himself ever come across these creatures in their native wilds. A later German traveler, Herr von Koppenfels, appears, however, to have been more fortunate, and states that he once observed a male and female with their two young quietly feeding.

From this account, and also from the natives, we know that gorillas habitually live in small families (as in our illustration), having young ones of various ages with them; and that they frequent the most gloomy recesses of the forest, where the light of day is reduced to a twilight so dim, that on cloudy days it might be supposed that the sun was eclipsed. The climate of these forests is hot and damp, suggestive of a Turkish bath or hothouse; and as in most primeval forests, signs of animal life are extremely rare, although the stillness may be broken now and then by the voice of a bird. According to the account given by Herr von Koppenfels (although this does not appear to be supported by others) gorillas are in the habit of making a kind of nest in the trees by bending the boughs together and covering them with twigs and moss at a height of several yards above the ground. In this nest the female and young pass the night, while the male takes his station at the bottom of the tree, where he remains in a sitting posture during the night, ready to protect his family against the attacks of prowling leopards. This writer likewise assures us that gorillas do not frequent the same sleeping place for more than three or four nights consecutively; and this is but natural when we reflect that these creatures must needs wander considerable distances in search of fresh supplies of suitable food.

Contrary to the custom of most wild animals, other than monkeys, gorillas appear to roam the forest in search of food solely during the daytime, and are totally stationary during the night. As a rule, they appear to walk on all fours; and while, in walking, the fingers of the hand are usually doubled on to the palm, the whole sole of the foot is applied to the ground. They can, however, walk with the fingers extended, and likewise with the toes bent down on the sole of the foot.

Although in appearance male gorillas are somewhat unwieldy creatures, yet, like all their kindred, they are most active and indefatigable climbers, and are said to ascend to the very tops of the forest trees, where they will pass from tree to tree almost as readily as the far lighter spider monkeys of Brazil. They also appear capable of taking leaps from great heights to the ground without damage to themselves, since Herr von Koppenfels tells us he even saw an adult spring from a tree at a height of some thirty or forty feet, and on alighting rapidly disappear into the scrub.

Although when driven to close quarters the gorilla is doubtless one of the most terrible of foes, yet it appears certain that very exaggerated accounts have been given of the natural ferocity. Herr von Koppenfels, as quoted by Dr. Hartmann, informs us that so "long as the gorilla is unmolested he does not attack men; and, indeed, rather avoids the encounter." And when these creatures catch sight of

men, they generally rush off precipitately in the opposite direction through the underwood, giving vent at the same time to peculiar guttural cries.

It appears that many gorillas are killed by the natives with the aid of a weighted spear suspended by a cunningly devised system of cords in the creature's path. Others are, however, undoubtedly shot by the negroes, although it would seem that, at least in many instances, such animals have been accidentally met by the hunters as they traveled through the forest rather than deliberately sought out and tracked. As we have already seen, both the members of the German Loango Expedition and Mr. Winwood Reade express their belief that up to the dates of their respective explorations of the West Coast no European had ever shot a gorilla. According, however, to letters from Herr von Koppenfels, referred to by Dr. Hartmann, that traveler states that up to the early part of 1874 he had himself shot four gorillas.

In Captivity With regard to gorillas in captivity, the accounts to hand are necessarily somewhat meagre; but, apart altogether from the climatal difficulties of keeping these creatures alive for any length of time in Europe, all authorities seem to be agreed that they are utterly untamable. Du Chaillu states that he had two young gorillas, the first of which was exceedingly ferocious and unmanageable, and both of which came to an untimely end. Herr Lenz, who published in 1878, at Berlin, under the title of *Sketches from West Africa*, the results of his African experiences, received from the natives of the Gabun a young male gorilla, of which he wrote an account in a letter addressed to and published by Dr. Hartmann. Nothing definite is, however, stated in this account as to the disposition of the animal, attention being mainly directed to the question how to accustom it to a diet such as could be obtained on board ship or in Europe. In spite of this training process, this gorilla died on the voyage to Germany.

We have already mentioned that the members of the German Loango Expedition received in 1875 a young male gorilla captured by native hunters. From the account of this animal, given in the report of the expedition by Herr Falkenstein, it appears that when first received at the station of Chinxoxo in Loango, the hardships which it had undergone in its transit down country had reduced the creature to a deplorable condition. By the aid, however, of a plentiful supply of wild and other fruits, and the milk of a goat, the young animal was gradually restored to something approaching its normal state of health; and preparations were then made for its transport to Berlin. Having been thus gradually accustomed to eat fruits and other food which could be procured on board ship, as well as to be in the company of Europeans, this young gorilla was finally shipped for Berlin. During the voyage it appears that it was never chained up, and it was soon allowed to wander freely about the ship, with but very slight supervision. This animal appears to have been of a gentle disposition, and although self-willed was never malicious. In taking its food it was remarkably well-behaved, helping itself from a plate with its thumb and two fingers; and even carrying small vessels of water to its mouth, and replacing them undamaged when empty. When larger vessels of liquid were put before it, it would lower its mouth to them and drink by suction. Its regard for personal cleanliness was also noteworthy; and when foreign sub-

stances adhered to it, it either brushed them off or held out its arms in a manner clearly indicating that it wished them removed.

When not able to obtain any article it desired, or when otherwise thwarted in its wishes, this young creature had recourse to various clever devices by which its object might be attained. For instance, it is related that "when he felt a desire for the sugar or fruit, which was kept in a cupboard in the eating room, he would suddenly leave off playing, and go in an opposite direction to the room, only altering his course when he believed that he was no longer observed. He then went straight to the room and cupboard, opened it, and made a quick and dexterous snatch at the sugar box or fruit basket, sometimes closing the cupboard door behind him before beginning to enjoy his plunder, or, if discovered, he would escape with it; and his whole behavior made it clear that he was conscious of transgressing into forbidden paths. He took a special, and what might be called a childish, pleasure in making a noise by beating on hollow articles, and seldom missed an opportunity of drumming on casks, dishes, or tin trays, whenever he passed by them." Strange noises, more especially thunder, alarmed him much.

This gorilla arrived safely at Berlin, where it was for a considerable period an inmate of the Aquarium. There it thrived at first, and was docile, though inclined to be mischievous. Eventually, however, it succumbed to the malady which sooner or later carries off all the large Man-like Apes in our climate, dying of a rapid consumption in the autumn of 1877, after having lived for fifteen months in Berlin.

By the intervention of Messrs. Pechuel-Loesche and Falkenstein, a second living gorilla was obtained from the Loango district, and safely transported to Berlin, where it arrived in the early part of 1883. The journey during the winter appears, however, to have left its mark on the constitution of this animal, and after living for fourteen months in the Aquarium it died of the same disease as its predecessor in the spring of 1884. Dr. Hartmann states that there was a third live gorilla at Berlin in the autumn of 1881, which died soon after its arrival. There was also a young gorilla a few years ago in the London Zoological Gardens, which only lived a few months.

These appear to have been the only living gorillas which have been exhibited as such in Europe. Curiously enough, however, as far back as the year 1860, a traveling showman in England actually had a veritable living gorilla in his exhibition, which he considered to be a chimpanzee, no one suspecting till long after the creature's death the treasure he had possessed.

THE ORANG-OUTANG

Genus *Simia*

Partly from the reddish hue of its hair, and partly from the conformation of its face and skull, as well as from the much greater proportionate length of its arms, the great man-like ape of Borneo and Sumatra is a very different looking creature to either the chimpanzee or the gorilla. Owing, however, to the circum-



ORANGS IN THEIR NATIVE WOODS.

stance that our figures of these animals generally take the form of zinc etchings, the marked contrast between the coloration of the orang (*Simia satyrus*), and that of its African cousins is unfortunately not presented to our view.

The name Orang-outang (generally shortened in works on zoology to Orang) is a Malay word, signifying Man-of-the-Woods; and the ape so designated was known to Linnæus, at least as far back as the year 1766. It was not, however till a considerably later date that it became fully known in Europe. It is true, indeed, that in 1780 Baron Wurmb, then the governor of the Dutch settlement of Batavia, transmitted to Holland the entire skeleton of an orang; but he did not recognize it as such, calling the animal to which it belonged the Pongo—a name which, as we have seen, belongs to the gorilla. In 1804 an orang was, however, living in the menagerie that belonged to the Prince of Orange; and this example was in that year described and depicted by a naturalist named Vosmaer. Subsequently to this the identity of Wurmb's pongo with the orang was fully demonstrated; and from that period our knowledge of the structure and habits of this ape has gradually increased. Among those who have especially contributed to advance our knowledge of the orang in its living condition we may mention "Raja" Sir James Brooke, of Borneo, and Mr. A. R. Wallace, the latter of whom has given us such graphic accounts of the creature's habits, in his fascinating work, the *Malay Archipelago*.

In the uncongenial climate of Europe, orangs are as difficult to keep for any lengthened period in confinement as are the large Man-like Apes of Western Africa. The case is, however, very different in the moist subtropical climate of Calcutta, where adult orangs have thriven well in cages exposed to the open air, and have taught us many facts in relation to their habits.

The leading or, as zoologists say, generic characters distinguishing the orang from the chimpanzee and gorilla are to be found in the proportionately greater length of the arms—which in the upright position reach to the ankles—in the form of the skull—which is elevated almost into a point at the summit—as well as in a difference in the number of the joints in the backbone and of bones in the wrist. Thus there are sixteen (instead of seventeen) vertebræ in the backbone between the neck and the sacrum; twelve of these carrying ribs, as in man. In regard to the number of bones in the wrist, we find that the orang possesses the central bone which is wanting in man, the chimpanzee, and the gorilla; and thus has nine, in place of eight, bones in the wrist. In this respect the Bornean ape agrees with the lower members of its order; but in the absence of callosities on the buttocks it shows its kinship with the gorilla and chimpanzee.

All these characteristic features clearly indicate that the orang is decidedly lower in the scale than the two Man-like Apes of which we have already treated; but before going further we must examine more closely into its structure and appearance.

Structure An adult male orang stands about 4 feet 4 inches in height when in an upright position, in which posture it can almost touch the ground with its fingers. The legs are extremely short and thick, and are twisted in such a remarkable manner that the knees are turned outwards, and the feet consequently set very obliquely to the line of the leg. From the peculiar structure

of its legs and feet the orang walks entirely on the outer sides of its feet, of which the soles are turned inwards, so as to almost face one another. Although this arrangement is ill-adapted for walking rapidly on the ground, it is one admirably suited for climbing, in which these animals excel.

As shown in our illustration of the adult, the orang has a tall, elevated forehead, very different from the retreating one of the chimpanzee; and the whole aspect of the face is curiously flattened, with an oval contour. Not unfrequently there is a well-marked prominence in the middle of the forehead. Although there are slight ridges over the eyes, these are much less developed than in the chim-



HEAD OF ORANG.

panzee, and have, therefore, no sort of resemblance to the enormous ones of the gorilla. The extraordinary height of the crown of the head is well exhibited in our figure of the head and shoulders of an immature individual, the whole of this part of the head being curiously shortened and compressed from back to front. In the immature animal, of which the head is figured, the jaws are not very prominent, but they become much more projecting in old males. The bridge of the nose is generally much depressed and flattened, but the whole nose is generally larger than in the chimpanzee and gorilla, and not so much expanded at its termination, the wings of the nose being arched and narrow, and the small oval nostrils

separated from one another by a narrow partition. The mobile lips are usually comparatively smooth and thin, the upper one being characterized by its great length and breadth. In the adult of the orang, as shown in our illustration, the neck is surrounded by a kind of collar formed of folds of skin containing an internal cavity communicating with the larynx or upper expansion of the windpipe. In some very old males these pouches attain enormous dimensions, and by no means add to the personal beauty of their owner. The ear is small and well-formed, being much more human-like than that of the gorilla. Frequently the sides of the cheeks of the males have a warty protuberance, or callosity.

The body is by no means so powerfully built as that of the gorilla; and the sloping and stooping shoulders and extremely prominent abdomen make the whole shape of the animal ungainly in the extreme.

We have already alluded to the great length of the extremely powerful arms, which vastly augment the animal's climbing powers. The hand (shown in Fig. 9 of the illustration on p. 15) is even longer and more slender than that of the chimpanzee, and is characterized by the extreme shortness of the thumb, which scarcely reaches as far as the root of the first joint of the index finger. The fingers themselves are connected by a web, which extends for a third, or nearly half, the length of their first joints. With regard to the relative lengths of the fingers, there is some amount of individual variation; but the middle finger may exceed either of the others, while the ring finger is longer than the index, and the little finger relatively long. All the fingers are narrow and tapering, with well-formed arching nails.

The calves of the legs are less developed than in either the chimpanzee or gorilla, and the narrow flat heels are less projecting. The long and slender feet (shown in Fig. 10 of the illustration on p. 15) are likewise of a lower type of structure, as is particularly shown in the very small size of the great toe, which is peculiar among the Primates in frequently having no trace of a nail in the adult. Curiously enough old animals often lose the last joint of the great toe, apparently not through disease, but as a normal condition. Both the hands and feet on the backs, and the hands on their under surfaces, have wart-like callosities.

The general color of the orang's skin is bluish-gray, although it may have a more or less decided tinge of brown. In marked contrast to the general slaty hue of the face, there often occur yellowish-brown rings round the eyes, nostrils, and upper lip. The full reddish-brown hair is long, shaggy, and bristly, with a small admixture of woolly under-hairs. The hair of the head may either have a natural parting in the middle, as in our figure of the head and shoulders, or may be tossed in wild confusion, in some individuals standing almost upright. Usually there is a well-developed beard on the cheeks and neck. On the whole of the under surface of the body the covering of hair is thin and scanty, and it is even less developed on the face, ears, and the backs of the hands and feet.

The tusks of the male are of enormous size. In the female they are, however, much smaller; and this sex is also characterized by the lesser development of the folds and pouches of skin round the neck.

**Geographical
Distribution**

As we have said, orangs appear to be confined to the great islands of Borneo and Sumatra; and there has been considerable discussion as to whether there is more than one species. It was once thought that the large orang of Sumatra was specifically distinct from that of Borneo, and it accordingly received a separate scientific name. Later investigations indicate, however, that this is not the case, and that *S. satyrus* is common to both islands, although individuals vary considerably in their color; and Dr. John Anderson is of opinion that a dark and a pale race may be distinguished, the latter being devoid of the warty callosities on the sides of the face of the males. The Dyaks of Borneo, by whom the orang is generally designated the *Mias*, appear to be fully acquainted with these two races, calling the one provided with cheek excrescences the *Mias pappan*, and the one without these appendages the *M. rambli*.

In addition to these two varieties of the true large orang, the Dyaks recognize a third kind, which they distinguish as the *M. kassir*. These animals are much smaller than the true orang, and never have the excrescences on the cheeks. A young individual of this orang was described many years ago by Sir Richard Owen as *Simia morio*. An orang which lived a short time in the London Zoological Society's Gardens was at first considered to be an adult of this form, and to prove its right to be regarded as a distinct species. The orang in question was presented to the Zoological Society, in whose Gardens it was received during the spring of 1891, by Commander E. Rason, R.N., who wrote to Mr. P. L. Sclater, stating that he obtained the animal at Kuching, near Sarawak, in Borneo, from some natives, who brought it to him slung on a pole. "At first it was extremely savage, and tried to bite, but soon became comparatively tame, and after a week would allow itself to be carried about and made a pet of. After three months' time, 'George,' as Commander Rason called his pet, "does not seem to have grown in height at all, and, judging by the look of his teeth, must be about ten years old; but, having had plenty to eat and but little exercise, has grown much fatter." On the death of this animal, it was found, however, that its age was much less than had been supposed, all the milk-teeth being still in place. Although the shape of its head was decidedly larger than in the ordinary orang, this specimen does not appear to indicate decisively that the lesser orang is a distinct species.

Mode of Life Orangs are stated to be much more numerous in Borneo than in Sumatra; and, since dense, low-lying forests are essential to their existence, they are not found in the neighborhood of Sarawak, where the ground is hilly. The unbroken, large areas of primeval forests, occurring in many parts of Borneo, are the true home of the orang; such forests, according to Mr. Wallace, being like open ground to these apes, since they can travel in every direction from tree to tree, as easily as the North American Indian traverses his native prairie. In all their movements these apes are slow and deliberate; this being especially noticeable with the perfectly healthy adults which have been exhibited in the Zoological Gardens at Calcutta, where they enjoyed a climate not unlike their own. This deliberation in their movements is noticeable in Mr. Wallace's description of the manner in which orangs travel through the forest when undisturbed and at ease. We are told that they proceed with great circumspection along the larger branches of

the trees in the half upright position rendered necessary by the great length of their arms and the shortness of their legs. Almost invariably they select such trees as have their branches interlaced with the adjacent ones; and, when such boughs are within reach, they catch hold of them with their arms as if to try their strength, after which they deliberately venture upon them. Although the orang never leaps or jumps, and never seems to be in a hurry, yet he will make his way overhead in the forest as fast as a man can run on the ground below. In this progression the long powerful arms are of the greatest service; and it is by their aid that the orang plucks the choicest fruit from boughs too light to support his weight, and likewise gathers the leaves and young shoots to form his nest.

The orangs, like gorillas, go in small family parties, consisting of the parents, accompanied frequently by from two to four young ones. Although they will devour leaves, buds, and young shoots,—more especially those of the bamboo,—the chief food of the orang consists of fruit of various kinds, the prime favorite being the luscious but ill-smelling durian or jack-fruit. Of this fruit they waste a vast quantity, throwing the rejected rinds on the ground below.

Mr. Wallace describes the nest, or sleeping place, of the orang as being generally constructed in a comparatively small tree, at a height of from some 20 to 50 feet from the ground; a situation at this elevation being protected from wind by the taller surrounding trees. The Dyaks believe that the orang constructs a fresh nest every night; but, as Mr. Wallace remarks, if this were the case, the deserted nests would be much more common than they really are. These animals remain in their nests till the sun has risen sufficiently high to have dried the dew from the forest leaves. Their feeding-time is during the middle of the day; but it appears that they seldom return for more than two consecutive days to the same tree for this purpose. Mr. Wallace observes that the orang must have a task of considerable difficulty in getting at the interior of the durian, since this fruit is protected by a thick and tough skin, covered with strong conical prickles. Probably, however, the animal first bites off a few of these prickles or spines, and then makes a small hole into which it inserts its fingers, and thus manages to pull the fruit in pieces.

In Captivity Many accounts have been given of the habits of orangs in captivity. Of these the earliest is the one by Vosmaer relating to the young female, which, as we have already mentioned, was living in the menagerie of the Prince of Orange in 1776. A later account of an orang brought to Java was given about the year 1830 by Dr. Clark Abel. On board ship this animal was allowed to roam freely about, and soon became on good terms with the sailors, whom it surpassed in the agility with which it ascended the rigging. It was, indeed, often pursued by the sailors from one part of the rigging to the other, when, finding itself unable to escape from them by direct speed, it would swing itself out of their reach by grasping a loose end of rope, and thus bring the chase to an end. On other occasions this animal would wait among the rigging, or at the masthead, till the sailors were almost within touching distance, when it would suddenly lower itself to the deck by the nearest rope, or pass from one mast to another by means of the mainstay. Any attempts to dislodge the animal when

aloft, by violently shaking or swaying the ropes by which it was suspended, were found to be quite ineffectual, although it often appeared to the spectator that the muscles of the orang would be unable to withstand the strain to which they were exposed. In its playful moods this orang is described as swinging itself suddenly within arm's length of one of its pursuers, and after having struck him a harmless blow with its outstretched hand, as suddenly swinging off in the opposite direction.

Dr. Abel states that while in Java this orang was lodged in a large tamarind tree growing near the house of his master. Here he was accustomed to form a kind of nest or bed, for himself by plaiting the smaller boughs together, and strewing the platform thus made with leaves. In the daytime the animal was in the habit of lying in this couch with his head projecting over the edge, and thus watched with interest all the passers-by. When any of these happened to be carrying fruit, the ape would descend from his lair and endeavor to obtain a portion. At sunset, or even sooner, it would retire to its nest for the night; while at the first rays of dawn it would be again afoot, and endeavoring to obtain its usual food. When on board ship the masthead formed its usual sleeping place, where the creature would comfortably ensconce itself in the folds of a sail for the night. "In making his bed," writes Dr. Abel, "he used the greatest pains to remove everything out of his way that might render the surface on which he intended to lie uneven; and, having satisfied himself with this part of his arrangement, spread out the sail, and lying down upon it on his back, drew it over his body. Sometimes I preoccupied his bed, and teased him by refusing to give it up. On these occasions he would endeavor to pull the sail from under me or to force me from it, and would not rest until I had resigned it. If it was large enough for both he would quietly lie down by my side. If all the sails happened to be set, he would hunt about for some other covering, and either steal one of the sailor's jackets or shirts that happened to be drying, or empty a hammock of its blankets. His food in Java was chiefly fruit, especially mangosteens, of which he was extremely fond. He also sucked eggs with voracity, and often employed himself in seeking them. On board ship his diet was of no definite kind; he ate readily of all kinds of meat, and especially raw meat; and was very fond of bread, but always preferred fruits when he could obtain them. His beverage in Java was water; on shipboard it was as diversified as his food. He preferred coffee and tea, but would readily take wine, and exemplified his attachment to spirits by stealing the captain's brandy bottle; since his arrival in London, he has preferred beer and milk to anything else, but drinks wine and other liquors. In his attempts to get food, he afforded us many opportunities of judging of his sagacity and disposition." The continuation of Dr. Abel's account is too long to be quoted at length, but he gives several other interesting particulars of the habits of the animal during the voyage from Java to England. Although habitually gentle, this orang could be excited into paroxysms of violent rage, which he expressed by opening his mouth, showing his teeth, and seizing and biting such persons as were in his vicinity. This animal survived its arrival in England for about fifteen months, when it fell a victim to the disease so fatal to its kindred in our climate.

The ferocious nature of the orang, when angered or driven to bay, is confirmed by both Sir James Brooke and Mr. Wallace. An instance of this is related by the latter writer in the following words:—"A few miles down the river there is a Dyak house, and the inhabitants saw a large orang feeding on the young shoots of a palm by the riverside. On being alarmed he retreated towards the jungle, which was close by, and a number of the men, armed with spears and choppers, ran out to intercept him. The man who was in front tried to run his spear through the animal's body, but the mias seized it in his hands, and in an instant got hold of the man's arm, which he seized in his mouth, making his teeth meet in the flesh above the elbow, which he tore and lacerated in a dreadful manner. Had not the others been close behind, the man would have been more seriously injured, if not killed, as he was quite powerless; but they soon destroyed the creature with their spears and choppers. The man remained ill for some time, and never fully recovered the use of his arm."

The same writer relates the history of a young orang which he received in Borneo when it was only a foot high. When first carried home this tiny creature took such a firm grasp of its new owner's beard, that it was with difficulty it could be made to loose its hold. At the time of its capture there were no signs of teeth in its mouth, but in the course of a few days two of the lower incisor teeth were cut. There was at the time unfortunately no means of obtaining a supply of milk for the little ape; but Mr. Wallace overcame this difficulty by feeding it with rice water sucked from a bottle with a quill through the cork. The animal soon managed to suck comfortably enough from this contrivance; and when sugar and cocoanut milk were added to the mixture it thrived well enough on the diet. If its owner introduced his finger into the creature's mouth, it first of all sucked away vigorously, but soon found out its mistake, and pushed the finger away with angry screams like those of a disappointed child. When caressed this ape was contented and happy, but when laid down soon began to scream; and for the first two nights of its captivity was very noisy and restless. It was kept in a kind of cradle, made of a box, with a soft mat at the bottom. The little orang seemed to appreciate a frequent bath; and, indeed, when it required one announced the fact by loud screams. The process of drying and rubbing after each bath seems to have been a source of great enjoyment; and this was likewise the case when its hair was combed and brushed. At first it clutched vigorously by all four limbs at any object in its neighborhood, so that its owner had continually to be on his guard to save his beard. When it could find nothing better to do, it would nurse its own foot. Little by little the strength of the tiny creature's grip decreased, probably owing to the want of sufficient exercise. In order to remedy this, Mr. Wallace made a short ladder, from which the ape was suspended by its hands and feet for a quarter of an hour at a time. This exercise seemed at first to afford it pleasure, but afterwards it loosed its hold, first with one limb, and then with another, till it finally fell to the ground. These tumbles did not appear, however, to do it any material harm.

Mr. Wallace endeavored to construct a kind of artificial mother out of buffalo hide, which the baby orang might fondle. For a time this appeared to afford satisfaction, but eventually was discarded, as the animal was nearly choked with the



YOUNG ORANGS (1-5), AND GIBBONS (6-8).

hair it had torn off the skin and swallowed. After a week's captivity, the young ape was fed from a spoon, containing a mixture of soaked biscuit, egg, and sugar, or, at other times, sweet potatoes. This food was swallowed readily, and with apparent satisfaction; the creature making droll grimaces to express either pleasure or the reverse. When it had swallowed anything which appeared grateful, it drew in its cheeks, and screwed up its eyes; while, when the food was distasteful from want of sufficient sugar or other cause, the creature, after turning it about in its mouth for a short time, finally ejected it. If this rejected food were again offered to it, the animal displayed marked displeasure by loudly screaming and throwing its arms about.

After three weeks a young macaque monkey was introduced to the orang, and the two, although very different in demeanor, soon became fast friends. Mr. Wallace particularly noticed the helplessness of the young orang when compared with the macaque; and it appears that this character distinguishes the young of all the Man-like Apes from those of the lower monkeys. Even after the young orang had been about a month in captivity, it was very unsteady when placed on its hands and feet, and would frequently overbalance itself and topple over. When it required attention, it would cry loudly for a time, but if this met with no reply, the young creature would remain quiet till a step was heard approaching, when its calls would be at once renewed. Although at the end of four weeks the two upper incisor teeth had been cut, the little creature, doubtless owing to improper food, had not increased perceptibly in weight; and soon after it sickened and died of a kind of intermittent fever, to the great regret of its owner.

The illustration on p. 53 shows some of the postures assumed by a young orang formerly living in the Aquarium at Berlin.

Fossil Apes Under the head of the Chimpanzee we have already mentioned that a fossil species of ape apparently referable to the same genus has been found in the later Tertiary strata of Northern India. The same strata have also yielded the broken tusk, or canine tooth, of another large ape, which there is every reason to believe was a species of orang. If this be so, we shall be justified in considering that India was the original home of the ancestors of all the large Man-like Apes of the present day; and that from this centre their descendants have gradually dispersed to the eastward and southwestward. We thus have an easy explanation of the present peculiar geographical distribution of the various groups of large Man-like Apes now existing.

In addition to these fossil Indian apes we have, moreover, sure evidence that at an earlier part of the Tertiary Period, known as the Miocene Age, at least one species of large Man-like Apes inhabited Western Europe. This extinct creature has been named the *Dryopithecus*, and its remains have been found in France. It appears to have been about the same size as the chimpanzee; but differs from all the living Man-like Apes in the great length of the bony union between the two branches of the lower jaw. In this respect this ape, as we might have expected would be the case, approaches decidedly towards the lower monkeys.

THE GIBBONS

Genus *Hylobates*

With the gibbons we come to the last of the Man-like Apes, distinguished from those which we have hitherto considered, not only by their smaller size, lighter build, and longer arms, but also by the presence of small naked callosities on the buttocks, resembling those of the lower monkeys. They are, moreover, the only apes accustomed to walk in an upright position, in which, as shown in the illustration on p. 53, they are at times assisted by their long arms, although they can walk perfectly well with their hands clasped behind the neck.

Characteristics The gibbons, or long-armed apes, comprise several species found in the warmer regions of Southeastern Asia, and more especially in and around the Malay Peninsula. The largest of all the species only slightly exceeds 3 feet in height, while the others are not more than about 30 inches. Their arms are so long that they reach to the ankle, so that these animals can actually walk upright and at the same time touch the ground with their fingers. The head is well-shaped, without the upward prolongation of the crown that is so characteristic of the orang; and the lower jaw is remarkable for the great development of the chin, which is more human-like than that of any other ape. Moreover, from the absence of prominent ridges and crests, and the nearly upright forehead, the whole skull strikes one as approaching the human type far more nearly than do those of the other apes. This must not, however, be considered as an indication that the gibbons are of a higher type than the other Man-like Apes, since the contrary is clearly demonstrated by their long arms and the callosities on the buttocks. The resemblance of their skulls to the human type is, indeed, merely a superficial one, due to the circumstance that small animals must necessarily have proportionately larger brains than the larger members of the same group; and also to the absence of the strong ridges which are necessary for the powerful skulls of the larger forms, but would be quite useless in their smaller cousins. The superficial human-like characters of the skulls of the gibbons are, however, to a great extent destroyed by their long slender tusks, or canine teeth, which project far beyond the level of the other teeth. The long and narrow hands and feet of these animals (shown in Figs. 11-13 of the illustration on p. 15) are characterized by the great extent to which the thumb and great toe are respectively separated from the other fingers and toes, as well as by the flatness of all the nails. In color, the gibbons vary from black to yellowish-white; this variation occurring even in different individuals of the same species. The comparatively well-formed nose, as seen in our figure of the white-handed gibbon, imparts to their physiognomy an expression far less repulsive and forbidding than that which characterizes the larger Man-like Apes.

Disposition In disposition the gibbons are gentle and confiding; and when captured young they can be readily tamed. Their constitution is, however, even more delicate than that of the other Man-like Apes; and consumption soon terminates their existence in Europe, even when the greatest care and attention

are bestowed upon them. In the Zoological Gardens at Calcutta, gibbons thrive excellently ; and one, kept there some twelve years ago, was accustomed to make his presence known to people living more than a mile away by the loudness of his morning and evening cries.



THE WHITE-HANDED GIBBON.

Habits

All the gibbons are thoroughly arboreal in their habits ; and in the rapidity of their movements among the trees they offer a marked contrast to the more deliberate and somewhat sluggish motions of the orang. So rapid and lightning-like are these movements that one species—the hoolock — has been observed when in captivity at Calcutta, to catch birds on the wing that had flown

into its cage ; and there can be but little doubt that such habits are natural to these animals in their wild condition, when it is probable that birds thus captured constitute an appreciable portion of their food.

Although several of the species are found in the forests of the plains, the hoolock appears to be almost if not exclusively restricted to those of hilly districts. In marked contrast to the larger Man-like Apes, most of the gibbons go in large flocks or droves, which may comprise from fifty to a hundred, or even more individuals ; although, as with most gregarious animals, solitary males are occasionally observed. The long arms are the chief agents in their active movements among the trees ; and by their aid the distances they can swing from bough to bough, and thus from tree to tree, are of surprising length. When going down hill they travel at an extremely rapid pace, by swinging themselves in a downward direction from one bough till they catch another on a lower level, and so from that to the next one.

Although walking rapidly when on the ground, gibbons, as Mr. W. T. Blanford tells us, can easily be overtaken by men. The same writer observes that, "when walking on the ground, the hoolock rests on its hind-feet alone, with the sole flat on the ground, and the great toe widely separated from the other digits. The arms are usually held upwards, sometimes horizontally, their great length (as shown in our illustration on p. 56) giving the animal a very peculiar aspect."

We have already mentioned the fondness of the hoolock for small birds, and, in addition to this kind of diet, gibbons subsist mainly on various fruits and leaves, as well as young and tender shoots ; they also feed on insects and spiders, and the eggs and callow nestlings of birds.

The habit which makes the gibbons known to (as well as cordially hated by) all who dwell in the districts which they frequent, is their custom of uttering at morn and even cries of a peculiarly loud and somewhat unearthly nature. These cries consist in the repetition of two syllables in quick succession ; and the name hoolock is given to the Indian representative of the group in imitation of its cry.

The late Mr. Blyth observes that, "in all the genera of gibbon the thumbs of both the hands and feet are separated from the other digits to the base of the metacarpal and metatarsal bones," and then states that this characteristic is also found elsewhere among the Primates only in two genera of lemurs (*Indris* and *Propithecus*). The same writer goes on to say that at the time of his writing it was "not generally understood that the long-armed apes are true bipeds when on the ground, applying the sole flatly, with the great toe widely separated from the other digits ; the hands are held up to be out of the way, rather than for balancing, even when ascending a flight of steps, as I have seen repeatedly, but they are ever ready to seize hold of any object by which the animal can assist itself along, even as a human being commonly grasps a banister when ascending a staircase."

THE SIAMANG (*Hylobates syndactylus*)

The siamang is the largest of all the gibbons, and since it also differs in certain structural peculiarities, it may be taken first. This fine species is apparently confined to Sumatra, and its habits were described many years ago by the French natu-

ralist Duvaucel. The animal, when full-grown, stands a little over three feet in height when in the upright position. It is of a uniform glossy black color, with the exception of a gray or whitish beard, the hair on the body and limbs being comparatively long. The hair on the fore-arm is directed upwards towards the elbow, as in the larger Man-like Apes, whereas the other members of the genus have it pointing towards the wrist. There are, moreover, two other features in which this species differs from the other gibbons. The first of these peculiarities, and the one from which the animal derives its scientific designation, is the circumstance that the second and third toes of the foot are joined together by a thin web of skin, reaching in the male as far as the last joint, but in the female only to the middle one. The second distinctive peculiarity of the *siamang* is the possession of a pouch formed by folds of skin round the neck and throat, resembling that which has already been mentioned as occurring in the orang. Moreover, the chin is better developed than in all the other gibbons.

Duvaucel's is one of the earliest authentic accounts of the *siamang*.
Mode of Life that we possess. Writing from the neighborhood of Benculen in Sumatra, he states that "this species is very common in our forests, and I have had frequent opportunities of observing it, as well in its wild state as in bondage. The *siamangs* generally assemble in numerous troops, conducted, it is said, by a chief, whom the Malays believe to be invulnerable, probably because he is more agile, powerful, and difficult to reach than the rest. Thus united, they salute the rising and setting sun with the most terrific cries, which may be heard at several miles' distance; and which, when near, deafen, when they do not frighten. This is the morning-call to the mountain Malays, but to the inhabitants of the towns it is a most insupportable annoyance. By way of compensation, they preserve a most profound silence during the daytime, unless when disturbed in their repose or sleep. These animals are slow and heavy in their gait; they want confidence when they climb, and agility when they leap, so that they may be easily caught, when they can be surprised. But nature, in depriving them of the means of readily escaping danger, has endowed them with a vigilance which rarely fails them; if they hear a noise which is strange to them, even though they be at a mile's distance, fright seizes them, and they immediately take flight. When surprised on the ground, however, they may be captured without resistance, being either overwhelmed with fear, or conscious of their weakness and the impossibility of escaping. At first, indeed, they endeavor to avoid their pursuers by flight, and it is then that their awkwardness in this exercise is most apparent. Their body, too tall and heavy for their short, slender thighs, inclines forward, and availing themselves of their long arms, as crutches, they thus advance by jerks, which resemble the hobbling of a lame man whom fear compels to make an extraordinary effort."

Their want of agility when surprised on the ground is, however, amply made up for when in the trees, where they take long flying leaps. According to a German writer, Herr Rosenberg, *siamangs* inhabit forests in Sumatra at an elevation of some three thousand feet above the sea level, rarely leaving the trees to descend to the ground. At any sudden fright they rush violently down the mountain sides, by leaping from bough to bough and from tree to tree in the

manner already mentioned. According, however, to Mr. Wallace, in his *Malay Archipelago*, the siamang is decidedly slower in its movements than the other gibbons, not taking such tremendously long leaps, and keeping at a lower elevation in the trees. The extraordinary relative length of its arms is well indicated in the description by the same writer, who observes that in an individual about three feet in height, they measure five feet six inches from hand to hand, when stretched out at right angles to the body. A young siamang brought to Mr. Wallace, was at first somewhat savage, but soon became more amenable to discipline, feeding readily on rice and fruits. This individual, which Mr. Wallace had intended to transport to England, did not, however, long survive in captivity. And it appears that the Malays, who are stated to be adepts in keeping and taming wild animals, find it exceedingly difficult to keep siamangs for any length of time. Siamangs have been exhibited alive in the Zoological Gardens at Calcutta. In disposition they are regarded by the Malays as stupid and dull. Mr. Wallace considers that this species is found in the Malay Peninsula, but this is doubted by Mr. Blanford; and it appears, according to Mr. Wallace, to be but little known, even in Singapore, where the captive specimen, already mentioned, attracted a considerable amount of attention.

A white siamang is recorded by Sir Stamford Raffles as having been obtained by him in Sumatra.

THE WHITE-HANDED GIBBON (*Hylobates lar*)

We may take as our first example of the more typical species of the group, all of which are very closely allied, the white-handed gibbon, represented in the figure on p. 56. This species, like all the other typical gibbons, is considerably smaller than the siamang, standing about thirty inches in height; and it is also of a lighter and more slender build. Although subject to great individual variation in color, it may be always recognized by the pale color of the hands and feet, of which the upper surfaces are usually either white or yellowish-white. Another distinctive characteristic is to be found in the usual presence round the black skin of the naked face of a complete ring of more or less nearly white hairs; which, as is well shown in our illustration, imparts a most peculiar physiognomy to the animal. Occasionally, however, this white ring is almost absent; different individuals showing a gradation in this respect from those in which it is but very slightly developed, to those in which it attains its full proportions. The general color of the body and limbs of this gibbon varies from a full black, through various fulvous shades, to a yellowish-white. In opposition to what usually obtains in Mammals some individuals of this species have the back lighter than the under parts of the body; and it may occasionally be much variegated.

The white-handed gibbon is found throughout the Malay Peninsula, as far north as the province of Tenasserim, and may possibly reach into Lower Pegu. It inhabits the forests skirting the mountains, at elevations varying from about three thousand to three thousand five hundred feet above the sea level.

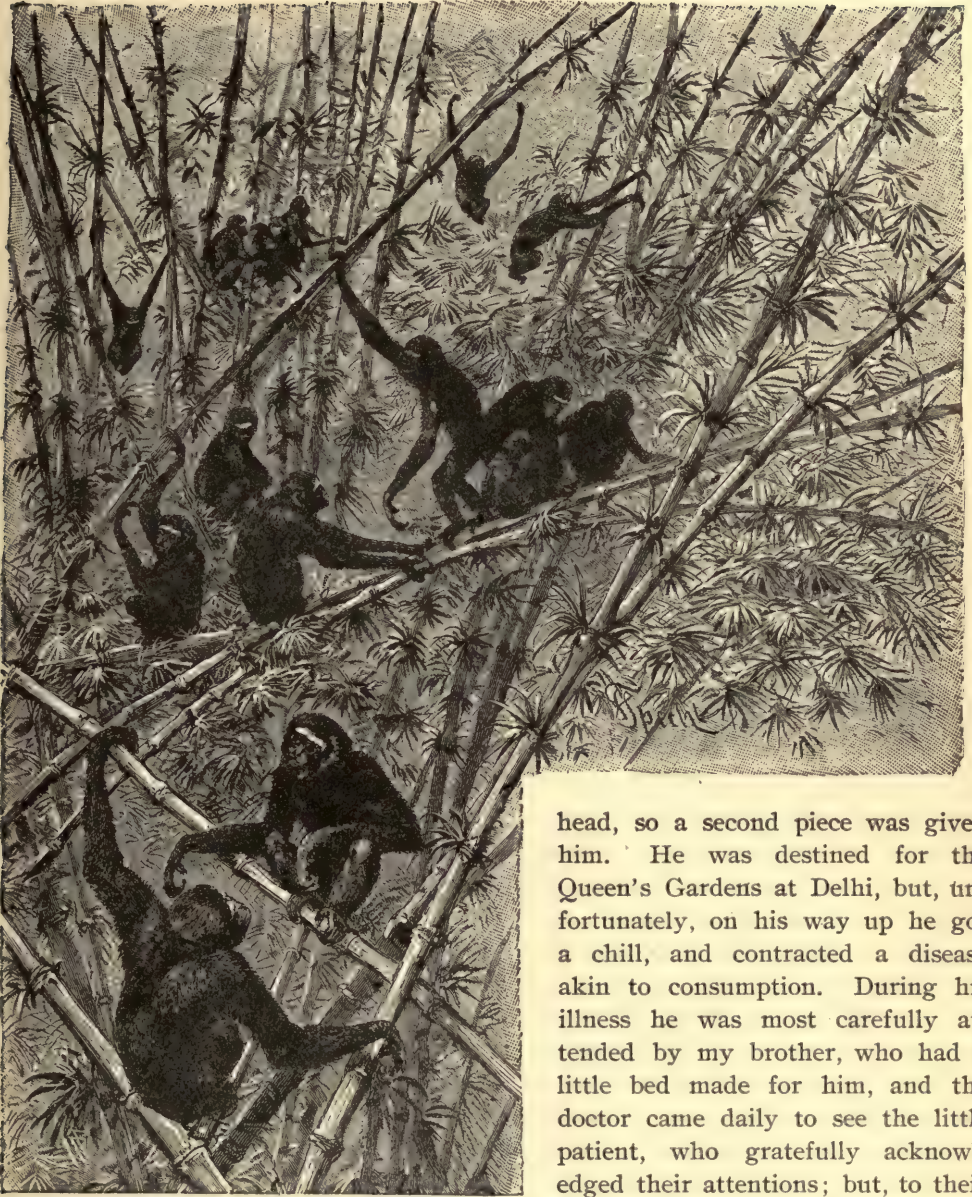
Mode of Life Colonel Tickell has given an excellent account of this gibbon, both in its wild state and in confinement. It appears from this description that the white-handed gibbon is somewhat more heavily built and less agile than the hoolock (to be noticed next), while it walks on the ground less steadily. It is also said to differ from the hoolock in its manner of drinking—scooping up water in its hands, and thus carrying it to its mouth, instead of applying its mouth directly to the surface of the water. The same observer also notices a great difference in the voices of the two species. The white-handed gibbons are also stated to go in smaller parties than the other species; the number in a drove, according to Colonel Tickell, being usually from six to twenty. They depend almost entirely on their hands in passing from bough to bough, and use their feet to carry food. He has seen a drove of these apes escape in this manner with the plunder stolen from a garden made by the Karen tribes near the forests which they frequent. Like other species of the group, the white-handed gibbon almost invariably has but a single young one at a time. The young are born at the commencement of the winter season, and cling to the body of the mother for nearly seven months, after which they shift for themselves.

THE HOOLOCK (*Hylobates hoolock*)

One of the best known of all the gibbons is the hoolock, or white-browed gibbon, which, as we have said, takes its name from its characteristic dissyllabic cry. This is the only species which occurs in India, where it is confined to the north-eastern districts, being found in the hill ranges south of the Assam valley, as well as in the provinces of Sylhet, Cachar, and Manipur. Thence it ranges to the east and southwards into the hill-forests of the Irawadi valley near Bhamo, in Upper Burma, and in the neighborhood of Chittagong and Arakan. It may also occur near Martaban, in Upper Tenasserim, and the extent of its range on the east side of the Irawadi river is not yet definitely determined.

The hoolock may be readily distinguished from the white-handed gibbon by the presence of a white or gray band across the eyebrows, and also by the whole of the rest of the head, as well as the upper surfaces of the hands and feet, being of the same color as the body. This general color varies from black to a light yellowish-gray, the females being generally paler than the males. As we have seen, their build is rather lighter, while their habits are more active than those of the last-named species.

Mode of Life All who have written of the hoolock agree as to its docile and engaging disposition, and the readiness with which, even when adult, it can be thoroughly tamed in a short space of time. Writing of a pet hoolock, formerly in his possession, Mr. R. A. Sterndale, in his *Mammalia of India* says: "Nothing contented him so much as being allowed to sit by my side with his arm linked through mine, and he would resist any attempt I made to go away. He was extremely clean in his habits, which cannot be said of all the monkey tribe. Soon after he came to me I gave him a piece of blanket to sleep on in his box, but the next morning I found he had rolled it up and made a sort of pillow for his



HOOLOCKS IN A BAMBOO JUNGLE.

head, so a second piece was given him. He was destined for the Queen's Gardens at Delhi, but, unfortunately, on his way up he got a chill, and contracted a disease akin to consumption. During his illness he was most carefully attended by my brother, who had a little bed made for him, and the doctor came daily to see the little patient, who gratefully acknowledged their attentions; but, to their disappointment, he died. The only objection to these monkeys as pets

is the power they have of howling, or rather whooping, a piercing and somewhat hysterical 'whoop-poo! whoop-poo! whoop-poo!' for several minutes, till fairly exhausted."

Under the heading of gibbons in general we have already alluded to the wide distance over which the cries of a hoolock kept in the Zoological Gardens at Calcutta could be heard. Mr. Blanford, writing of the cries of these animals, observes that "at a distance the sound much resembles a human voice; it is a peculiar

wailing note, audible from afar, and in the countries inhabited by these animals is one of the most familiar forest sounds. The calls commence at daybreak, and are continued until 9 or 10 A.M., several of the flock joining in the cry, like hounds giving tongue. After 9 or 10 o'clock in the morning the animals feed or rest, and remain silent throughout the middle of the day, but recommence calling towards evening, though to a less extent than in the earlier part of the day."

Like the white-handed gibbon, hoolocks have been exhibited, although less numerous, in the Gardens of the Zoological Society in Regent's Park.

The Hainan gibbon (*H. hainanus*), from the island of Hainan, China, is allied to the hoolock, but differs from that and all other species, except the siamang, by the absence of a white band on the forehead, and is thus black throughout.

THE AGILE GIBBON (*Hylobates agilis*)

According to Dr. John Anderson, the agile gibbon is subject to such an amount of individual variation that several so-called species, such as the Malay gibbon (*H. rafflesi*), of Sumatra, and the crowned gibbon (*H. pileatus*), of Siam, have been founded upon what appear to be nothing more than local races of one and the same species.

Inclusive of all these local varieties, the agile gibbon has a rather wide geographical distribution, ranging from Cochin-China to Siam; it is also found in Sumatra and Borneo, as well as in the small islands of the Sulu Archipelago lying between Borneo and the Philippines.

The activity of the agile gibbon is sufficiently attested by its name. It was this species which was first observed to have the power of catching birds while on the wing. According to Duvaucel, these animals are capable of taking clear leaps of forty feet when passing from bough to bough. They are stated to live generally in pairs rather than in droves, and are known to the natives of Sumatra as Ungka, or Ungka-puti.

In the typical form of the agile gibbon from Sumatra the general color is usually dark brown; the face being bluish-black or brown, and surrounded by whitish hair, through which the ears are only partially visible, and the hands and feet of the same general color as the body. It may be distinguished by the prominent arches on the skull above the eyes, the comparatively flat nose, and the large nostrils. The color of the back in the darker varieties is lighter than that of the under parts. The variety named after Sir Stamford Raffles, *H. rafflesi*, is of a nearly black color, tending to brown on the sides and back. The Siamese variety, known as the crowned or tufted gibbon (*H. pileatus*), is likewise of a blackish color, but differs in that the hands, feet, and a ring round the crown of the head are white. The white patch on the crown helps to distinguish this variety from the typical agile gibbon; although it must be confessed that all these Malay gibbons are singularly alike, and often difficult to distinguish even by the practiced zoologist. This so-called variegated gibbon (*H. variegatus*) appears to be but another of the numerous varieties of *H. agilis*.

THE WOU-WOU, OR SILVER GIBBON (*Hylobates leuciscus*)

The gray or silver gibbon, or wou-wou,—a name often incorrectly applied to the agile gibbon,—comes from the island of Java, and most zoologists agree in regarding it as a distinct species. It is characterized by its general ashy or bluish-gray color, the presence of a large square black patch on the top of the head, and also by the white or gray fringe of hair surrounding the blackish face. The fur also appears to be longer, thicker, and of a more woolly nature than is the case in the other species, and the color is stated to be usually lighter on the under parts than on the back. Specimens of both this and the preceding species have been exhibited in the London Zoological Society's Gardens.

FOSSIL GIBBONS

In the explorations which have been conducted in the caves of Borneo, remains of gibbons, probably belonging to species still existing in the same regions, have been met with in a subfossil condition. This is only what we should naturally have expected to be the case. Very different, however, is the occurrence of fossil gibbons in fresh-water strata belonging to the middle portion of the Tertiary period in France and Switzerland; for it is quite certain that these animals could not have existed in a climate at all approaching that now characterizing Europe. We shall, therefore, be safe in assuming that, at the period in question, portions of Southern Europe were clothed with dense forests, growing in a hot and moist climate closely resembling that of the Malay Archipelago of the present day. The evidence for the former prevalence of this tropical European climate does not, however, rest solely on the fossil gibbons, since many of the other animals found in the same strata are very similar to those now characteristic of the warmer regions of the East; while the presence of palms, resembling those of tropical regions, as well as other plants, supplements the evidence of the animals in a manner which must be convincing to all who pay any attention to the subject. After the middle or miocene division of the Tertiary period we have no evidence of the existence of gibbons in any part of Europe, although many kinds of monkeys were abundant until much later.



THE YELLOW BABOON.

CHAPTER III

APES, MONKEYS, AND LEMURS—*continued*

THE OLD WORLD MONKEYS AND BABOONS

Family *CERCOPITHECIDÆ*

ALTHOUGH there is some degree of uncertainty as to the precise significance to be attached to the names Apes, Monkeys, and Baboons, we shall take leave to restrict the former term to the Man-like Apes described in the preceding chapter, and use the two latter for those other Old World Primates which do not belong to the group of Lemurs. The name Monkey is, however, also applicable to one family of the Primates of the New World. Using then, the terms Monkeys and Baboons in this sense, we may mention, in the first place, that zoologists include the whole of those inhabiting the Old World in a single family, for which they adopt the name *Cercopithecidae*, taken from a genus of African monkeys. Our next point is to consider how all these numerous species are to be distinguished as a whole from the Man-like Apes on the one hand and from the American monkeys on the other.

Teeth

As regards the number of their teeth, all the Old World monkeys and baboons agree with the Man-like Apes; the total number of teeth being thirty-two, among which there are two premolars and three molars on both sides of each jaw. This character, as we shall subsequently see, will at once serve to distinguish any Old World monkey from an American monkey or marmoset. The Old World monkeys and baboons may, however, be distinguished from the Man-like Apes by the form of their cheek-teeth. We have, indeed, stated at the beginning of the preceding chapter that the premolar and molar teeth of the latter group closely resemble those of man; the crowns of the molars being relatively broad and surmounted by four low main tubercles situated at the four corners of each tooth, but arranged somewhat obliquely to its long axis. We may add that the last molar in the lower jaw is of the same general form as the two teeth immediately in front of it.

If, however, we take up the skull of any species of Old World monkey or baboon and carefully examine its molar teeth, we shall find that they will by no means accord with the foregoing description. We shall, indeed, recognize in these teeth the four tubercles at the corners; but instead of these tubercles being low, and set obliquely to one another, without any connection between those forming the front and hind pairs, we shall find that they are comparatively high, and are placed in pairs opposite one another, while each pair is connected together by a low imperfect transverse ridge. This two-ridged character of the molars, which is more distinct in the lower than in the upper teeth, is therefore a readily available method of distinguishing between an Old World monkey or baboon and a Man-like Ape. Moreover, with the single exception of one African genus of monkeys, and one Oriental species of another, the last lower tooth of all the monkeys and baboons of the Old World may be distinguished from that of the Man-like Apes by having a kind of projection or heel behind the second transverse ridge.

Nostrils

There are, however, other characters distinctive of the present group which must now be mentioned. In the first place, if we observe the nose of an Old World monkey we shall not fail to notice that the vertical partition dividing one nostril from the other is comparatively thin; this characteristic affording a well-marked distinction from the monkeys and marmosets of the New

Tail

World. We have already seen that no Man-like Ape has a tail; but there is great variation in this respect among the members of the present group, some of them having exceedingly long tails, others short tails, and a few no tails at all. In no instance, however, are the tails of this group endued with the power of prehension, as they are in the American monkeys. Here we may remark, in passing, that it has been very often considered that the term Monkey should be restricted to such species as have long tails, while those with short tails should be called Baboons, and those with no tails at all Apes. This application of terms will not, however, hold good when put in practice; since, if it were adopted, we should have to call certain of the different species of one single genus of monkeys by all the three names.

In all the monkeys and apes of the Old World, those peculiar patches of hard naked skin on the buttocks, known as callosities, which we have already mentioned

as occurring in the gibbons, are invariably present. These callosities, which are not unfrequently bright colored, afford another characteristic by which we can at once distinguish an Old World monkey from any and all of its American cousins. Their use is to afford a comfortable rest for the body in the upright sitting posture assumed by the monkeys and baboons of the Old World.

Another feature absolutely peculiar to the monkeys and baboons of the Old World, although by no means common to the whole of them, is the presence of those pouches in the cheeks, with which all who have fed tame monkeys must be perfectly familiar. These cheek pouches are formed by folds in the skin, and when empty lie flat on either side of the face. They can, however, be so distended as to contain a large quantity of food, and then stick out prominently on either side, so as to communicate a peculiarly bloated appearance to the face. The possession of these pouches must obviously be a great advantage to the monkeys in which they are found, since by their means a large quantity of food can be hurriedly gathered, stowed away, and afterwards eaten at leisure in some place of security. It might, indeed, be urged that the monkeys which do not possess these convenient receptacles appear to get on in life quite as well as their relations who are thus provided, and that, therefore, these pouches are of no real advantage. To this it may be replied that such Old World monkeys as have no cheek pouches feed much more on leaves and shoots than on fruits; and that they are furnished with a peculiarly complex stomach in which this food can be rapidly stowed away previously to undergoing complete digestion.

With regard to the limbs of the Old World monkeys and baboons, it may be observed that the arms never present that great excess in length over the legs which we have seen to be the case among the Man-like Apes, and the legs may, sometimes, be the longer of the two. The thumb of the Old World monkeys and baboons can in all cases be fully opposed to the fingers, except, of course, in the African species in which it is either absent or rudimentary, and therein have another marked point of difference from the American group.

Finally, the skeletons of all members of the present group may be readily distinguished from those of the Man-like Apes by the breastbone being narrow and flattened from side to side, instead of broad and flattened from back to front. Moreover, all of the species have a central bone in the wrist, —a characteristic they have in common with the gibbons and oranges among the Man-like Apes.

Such, then, are the leading features by which the monkeys and baboons of the Old World (forming a larger group than any other in the order) are distinguished from the groups immediately above and below them in the zoological scale; and the reader who has followed us carefully thus far ought to be able to tell at once whether any particular monkey that is set before him should or should not be included in the present group. When we speak of the members of this group occupying a position immediately below that of the Man-like Apes, we must guard ourselves from conveying the idea that the one can in any sense be regarded as the ancestor of the other. The difference in the structure of the molar teeth of the two groups is alone sufficient to prove that this cannot be

the case, those of the Man-like Apes being of a more primitive type than are those of the monkeys and baboons. The common ancestor of the two groups must indeed probably be sought in some long extinct type more nearly akin to the lemurs.

Although the majority of the Old World monkeys and baboons are inhabitants of the warmer regions of the Eastern Hemisphere, yet the group is by no means so strictly confined to tropical and subtropical regions as we have seen to be the case with the Man-like Apes. Indeed, some of the Asiatic species are capable of withstanding a very considerable degree of cold, and may be found among the snows of the Himalayas and Tibet.

THE LANGURS

Genus *Semnopithecus*

With this group of long-tailed Asiatic Monkeys, we come to the first of three nearly allied genera, all of which are characterized by their extremely slender and "lanky" build, by the excessive length of their tails, by the legs being longer than their arms, and by the absence of cheek pouches. All the above characteristics can be verified in the living animal, but there is one other for the examination of which we must turn to the dissecting room of the anatomist. This internal character relates to the stomach, which, instead of having the simple bladder-like form which it assumes in all other members of the order, is divided into a number of pouches or sacs. When the peculiar pouched stomach was first described scarcely anything was known as to the habits and food of the monkeys in which it is found. Sir Richard Owen, however, sagaciously suggested that from the analogy presented by this peculiar type of stomach to that which characterizes the Ruminating Hoofed Mammals, as well as some other vegetable-feeding animals, it would be found that the food of these monkeys consisted in great part of leaves. This suggestion has been fully confirmed by subsequent observations; and although the habits of the langurs are still but imperfectly known, yet it is stated by Mr. W. T. Blanford that they are more purely herbivorous than those monkeys which are provided with cheek pouches, and that a very considerable portion of their food consists of leaves and the tender shoots and young twigs of trees. The presence of this remarkable kind of stomach is, indeed, as we have already mentioned, a kind of compensation for the absence of cheek pouches; it being more suited to the needs of these animals than the pouches would be.

The langurs are so called from the name applied by the natives of Northern India to those species of the group which inhabit the outer ranges of the Himalayas. Langurs, which are known in Germany as *Schlankaffen*, or slender monkeys, are found over a large portion of Southeastern Asia, being especially abundant in India and Burma, and represented by one species in the highlands of Tibet.

Structure As their German name implies, the bodies and limbs of these monkeys are exceedingly slender; while the tail is so long that very generally, and invariably in all the species from India, Ceylon, and Burma, it is actually longer than the whole length of the head and body together. This is well

shown in our figure of the true langur or hanuman monkey. In all the species the thumb is well developed; this being a character of great importance, as the chief one by which these monkeys are distinguished from some closely allied African monkeys. The row of long stiff black hairs seen in our figure, projecting from above the eyebrows of the langurs, is another feature by which these monkeys may be easily recognized. Further, the skulls of all the langurs may be readily



THE HANUMAN MONKEY, OR TRUE LANGUR.

distinguished from those of all other monkeys, with the exception of the allied African group mentioned above, by the circumstance that the aperture for the nostrils, which is exceedingly narrow, extends upwards between the sockets for the eyes, instead of stopping at about the level of their lower border.

Almost the earliest account that we have of the langurs relates to those of Ceylon, and was given in the year 1681 by one Robert Knox, an English seaman, who for nearly twenty years had been a prisoner in that island. Knox says that

some of the Singalese monkeys "are as large as our English spaniel dogs, of a darkish-gray color, and black faces, with great white beards round from ear to ear, which make them show just like old men. They do but little mischief, keeping in the woods, eating only leaves and buds of trees; but when they are caught they will eat anything. This sort they call in their language wanderows (wanderus)." This account has been thought to apply to the lion-tailed monkey (a macaque), which was formerly incorrectly called the Wanderu. That monkey is, however, black; and there is not the slightest doubt but that Knox described the langurs, which are the wanderus of the Singalese.

THE HANUMAN, OR TRUE LANGUR (*Semnopithecus entellus*)

Perhaps the best known of all the langurs, and the one which gives the scientific name to the genus, is the hanuman monkey, or true langur, of which we give a figure. This fine monkey is found throughout the northern part of Peninsular India, from Southwestern Bengal and Orissa to Gujerat and Bombay, and is also found in Kattywar, and probably Katch, although unknown in Sind and the Punjab. Southwards it ranges into the Bombay Deccan; while its extreme northern limit extends to the outer ranges of the Himalayas, although there is still some doubt as to where the range of this species ends and that of the next begins.

The hanuman is one of four species of Indian langurs, characterized by having the hair covering the crown of the head radiating in all directions from a central point situated on the forehead. It is distinguished from its allies by the absence of any crest of hair on the head, of which the color is scarcely, if at all, paler than that of the back, and by the full black color of the upper surfaces of the hands and feet. The hair of the cheeks does not cover the relatively large ears. The general color is grayish-brown, paler in some individuals than in others; but the face, ears, feet, and hands, are coal-black. In size a large male hanuman will measure some 30 inches in head and body; but average specimens will be about 25 inches, while their tail will measure as much as 38. As Mr. Sterndale has well observed: "The *tout ensemble* of the langur is so peculiar that no one who has once been told of a long, loose-limbed, slender monkey, with a prodigious tail, black face, and overhanging brows of long, stiff, black hair, projecting like a penthouse, would fail to recognize the animal."

Mode of Life Langurs are exceedingly common throughout a large part of India, and in most districts are held sacred by the Hindus, by whom they are allowed to plunder the grain shops at will. Mr. Sterndale considers, however, that the best times of the hanuman are over, and that it is not now allowed the free run of the bazaars so readily as it once was, while in some districts the aid of Europeans has even been invoked to rid the natives from the devastations of these monkeys, which take their name from the god Hanuman, to whom they are sacred.

As Mr. W. T. Blanford observes, the protection accorded to the hanuman by the Hindus of Northern India has caused these animals to be so tame, and so utterly regardless of the presence of man, that there are but few Mammals whose habits can be so well observed. The same writer states that, "The hanuman is usually

found in smaller or larger communities, composed of individuals of both sexes and of all ages, the youngest clinging to their mothers, and being carried by them, especially when alarmed. An old male is occasionally found solitary, as with so many other Mammals. The story that males and females live in separate troops, though apparently believed by Blyth and quoted by Jerdon, I agree with Hutton in regarding as fictitious, though as the latter observes justly remarks, females with very young offspring may keep together, and temporarily apart from the remainder of the troop to which they belong."

In regard to the cry of these langurs, Mr. Blanford observes that, "Their voice is loud, and is often heard, especially, in the morning and evening. The two commonest sounds emitted by them are a loud, joyous, rather musical call, a kind of whoop, generally uttered when they are bounding from tree to tree, and a harsh guttural note, denoting alarm or anger. The latter is the cry familiar to the tiger hunter, amongst whose best friends is the hanuman. Safely ensconced in a lofty tree, or jumping from one tree to another, as the tiger moves, the monkey by gesture and cry points out the position of his deadly enemy in the bushes or grass beneath, and swears at him heartily. It is marvelous to observe how these monkeys, even in the wildest forests where human beings are rarely seen, appear to recognize men as friends, or at least as allies against the tiger. It is a common but erroneous notion of sportsmen that this guttural cry is a sure indication of a tiger or leopard having been seen, whereas the monkeys quite as often utter it merely as an expression of surprise; I have heard it caused by the sight of deer running away, and I believe that it is frequently due to the monkeys catching sight of men."

The food of the hanuman consists largely of leaves and young shoots and also grain of all kinds, especially in the towns. In disposition the hanuman is gentle, and appears never to attack human beings. Its constitution is delicate when in captivity,—probably from the want of suitable food,—but the species is generally well represented in the London Zoological Society's Gardens.

Their Battles That troops of langurs sometimes engage in fierce contests is proved by an interesting account given by Mr. T. H. Hughes, from which the following extract is taken. Mr. Hughes says that, "In April 1882, when encamped at the village of Singpur in the Sohagpur district of the Rewa State, my attention was attracted to a restless gathering of hanumans in the grove adjoining the one in which my tent was pitched; and, wishing to form some idea as to its cause, I strolled to where the excitement was greatest, and found two opposing troops engaged in demonstrations of an unfriendly character. Two males of one troop, fair-sized brutes, and one of another, a splendid-looking fellow of stalwart proportions, were walking round and displaying their teeth. The solitary gladiator headed a much smaller following than that captained by the other two, and, strange to say, instead of the whole number of monkeys joining in a general *mêlée*, the fortune of the question that had to be decided appeared to have been entrusted to the representative champions. It was some time, at least a quarter of an hour, before actual hostilities took place, when, having got within striking distance, the two monkeys made a rush at their adversary. I saw their arms and teeth going viciously, and then the throat of one of the aggressors was ripped right open, and he lay dying. He had done

some damage, however, before going under, having wounded his opponent in the shoulder, and matters then seemed pretty evenly balanced between the remaining strugglers. I confess that my sympathies were with the one champion who had gallantly withstood the charge of his enemies; and I fancy the tide of victory would have been in his favor had the odds against him not been re-enforced by the advance of two females. I felt that the fight was not a fair one, but was deterred from interfering by a wish to see what the end of the affray would be, and the end, so far as the solitary hanuman was concerned, soon came. Each female flung herself upon him, and though he fought his enemies gallantly, one of the females succeeded in seizing him. Possibly he would have been killed outright had I not been present, but when I saw him so helpless, I interfered on the chance of being able to save him. He was, however, hopelessly mutilated, and before the morning he was dead. Not one of his own troop came to his aid. I presume they were either awed by the array of numbers on the other side, or they had full confidence in their leader. Had they assisted, they might in the end have been better off, for the result of the defeat of their champion was that the whole of the aggressors entered upon a guerilla warfare, and, isolating several of the members of the weaker troop, kept them prisoners under surveillance. Whenever the latter tried to break away, their guards stopped them, and then effectually watched them by occupying every piece of vantage ground. One female with a young one was most viciously chased, and when, in her efforts to escape her enemies, she climbed to one of the highest limbs of a big tree, those in pursuit actually shook the branch on which she was, and jerked her to the ground. The fall was a nasty one, and she was so badly hurt that in the course of the night she went to swell the list of the fatally wounded. The defeated troops were thoroughly cowed, for one of the number actually allowed me to approach it quite closely without moving. I certainly do not ascribe the onslaught I saw to sexual excitement. It was plainly an incursion of a stronger troop into the domain of a weaker one; and, under mistaken counsel, the weaker hesitated too long in yielding their feeding ground."

THE HIMALAYAN LANGUR (*Semnopithecus schistaceus*)

Very closely related to the hanuman is the Himalayan langur (*S. schistaceus*), so closely indeed that Dr. John Anderson considers it ought only to be reckoned as a variety of that species. In the opinion of Mr. Blanford—our most recent authority on Indian Mammals—it is, however, considered to be entitled to rank as a well-marked species; and this observer gives the following characteristics by which it may be distinguished from the hanuman. The Himalayan species is characterized "by being somewhat larger,—although there is probably no great difference between large individuals of both species,—by the head being much paler in color than the back, and by the feet being but little, if at all, darker than the limbs; by the smaller ears, and by their being concealed by the long hair of the cheeks; by the form of the skull."

This species is found throughout the greater part of the Himalayas proper, ranging from Bhutan in the southeast to the Kashmir valley and adjacent regions

in the northwest. It appears not to be found below five thousand feet, and in the interior of Sikhim it ranges as high as twelve thousand feet. One of the first, if not actually the first record of the occurrence of the Himalayan langur in the interior of Sikhim will be found in Sir J. W. Hooker's *Himalayan Journals*. The author of that charming book of travel says, on arriving at a Tatar village, at an elevation of about nine thousand feet: "I saw a troop of large monkeys gamboling in a wood of *Abies brunoniana*; this surprised me, as I was not prepared to find so tropical an animal associated with a vegetation typical of a boreal climate." Other writers have observed these langurs in the outer ranges of the Himalayas in the neighborhood of the hill stations of Simla or Mussuri, leaping from bough to bough of the snow-clad pines and deodars. And the present writer was himself once sufficiently fortunate to behold a similar sight when crossing a pass called the Rutten Pir, in the mountains to the south of the valley of Kashmir. On a sudden, when passing through a forest composed partly of pines and deodar cedars and partly of rhododendrons, a whole troop of these langurs dashed across the path, springing from tree to tree, and scattering in all directions the thick wreaths of snow with which the dark fir boughs were concealed, the season of the year being the middle of the spring.

In the autumn these langurs are to be found in large droves in the extensive forests of the higher valleys surrounding Kashmir. Here they are a decided nuisance to the hunter, as their cries will not unfrequently alarm the deer or bear which he may be pursuing. Desirous of securing a skull, the writer was once tempted to shoot a large male out of one of these droves; but the cries and expression of the poor wounded brute were so human-like that he never again could persuade himself to shoot a monkey of any kind.

THE MADRAS LANGUR (*Semnopithecus priamus*)

In Madras and Ceylon the hanuman is represented by an allied species known as the Madras langur (*S. priamus*), distinguished by possessing a distinct crest of hair on the crown of the head, and by the upper surfaces of the feet and hands not being black. The following account of the habits of this species is taken from Sir J. Emerson Tennent's *Natural History of Ceylon*, where all the langurs are known as wanderus. The Madras langur "inhabits the northern and eastern districts and the wooded hills which occur in these portions of the island. In appearance it differs both in size and color from the common wanderu (*S. cephalopterus*), being larger and more often grayish; and in habits it is much less reserved. At Jaffna, and in other parts of the island where the population is numerous, these monkeys become so familiarized with the presence of man as to exhibit the utmost daring and indifference. A flock of them will take possession of a palmyra palm; and so effectually can they crouch and conceal themselves among the leaves that, on the slightest alarm, the whole party becomes invisible in an instant. The presence of a dog excites, however, such an irrepressible curiosity that, in order to watch his movements, they never fail to betray themselves. They may frequently be seen congregated on the roof of a native hut; and, some

years ago, the child of a European clergyman stationed near Jaffna, having been left on the ground by the nurse, was so teased and bitten by them as to cause its death."

The Malabar langur (*S. hypoleucus*), which is common not only in the forests, but likewise on the cultivated lands fringing the Malabar coast, is the last member of the group in which the hair of the crown of the head radiates from a single point on the forehead.

THE BANDED LEAF-MONKEY (*Semnopithecus femoralis*)

A rare langur from Sumatra, Borneo, and the Malay Peninsula, extending as far north as Tenasserim, is the banded leaf-monkey, of whose habits little, unfortunately, is known. It differs from all those already mentioned in that the hair of the crown of the head radiates from two distinct points on the forehead. The hair on the hinder part of the head stands up so as to form a crest; while that over the temples bends forwards to overhang the eyes. In color this monkey is much darker than any of the above species; it varies from blackish-brown to black over the greater part of the body, but is white over a larger portion of the under surface of the body and inner sides of the thighs, the white area always including the abdomen. The young are of a whitish hue throughout.

A closely allied, if not identical, kind of langur from the same regions has received the name of *S. chrysomelas*, and differs merely by some details of coloration.

It is a curious circumstance that the skulls of both these species or varieties of langurs can be distinguished from those of all others by the form of the last molar, or "wisdom-tooth," in the lower jaw. In all the other langurs this tooth has five tubercles; in the banded leaf-monkey it has but four, as in the under-mentioned group of guenons.

THE NEGRO MONKEY (*Semnopithecus maurus*)

Far better known than the last species is the negro monkey, or Budeng, as it is called by the inhabitants of Java, of which we give an illustration. This langur, which was originally obtained from Java, but, according to Dr. J. Anderson, is also found in Sumatra and the Malay Peninsula, takes its English name from the full black color prevailing over all the body in the adult, except a portion of the under surface, and the root of the tail, where it is replaced by gray. It agrees with the last in the forward projection of the hairs on the front of the crown of the head, as is well shown in the figure. The length of the head and body of this monkey is about 24 inches; the tail being longer than the head and body, and frequently furnished with a small tuft at the extremity. The young are light colored, being of a yellowish or reddish tint; the dark color of the adult appearing first on the hands, and then gradually spreading over the limbs and body. This light color of the young shows that the dark tint of the adults is an acquired or specialized characteristic.

Nearly allied to this species is another and much rarer monkey, found in Java, where it is called by the natives the lutong. It is known scientifically as

S. pyrrhus; and it differs from the negro monkey in being of a ferruginous red color at all ages, and is therefore evidently a less specialized form. So like, indeed, are the two that Dr. J. Anderson considered the lutong to be merely a light-colored variety of the budeng. More recently, however, Dr. Jentiuk, of Leyden, has shown that the skulls of the two present considerable structural differences, and he has accordingly no doubt that the two forms indicate perfectly distinct species.

Although in Java these two monkeys have perfectly distinct names, the Malays call both by the name lutong, distinguishing the negro monkey as the

Lutong itam, and the red species as the *Lutong mora*; the words *itam* and *mora* signifying respectively black and red.

The opinion that these two monkeys are distinct species is confirmed by a marked difference in their disposition, which was long ago pointed out by the late Dr. Horsfield, from whose work on the *Zoology of Java* we take the following account, with some slight verbal alterations. After observing that the black budeng is much more abundant than the red lutong, Dr. Horsfield observes that, "The latter, both on account of its rarity and comparative beauty, is a favorite with the natives. Whenever an individual is obtained, care is taken to domesticate it, and it is treated with kindness and attention. The budeng, on the contrary, is neglected and despised. It requires much patience in any degree to improve the natural sullenness of its temper. In confinement, it remains during many months grave and morose; and, as it contributes nothing to the amusement of the natives, it is rarely found in their villages or about their dwellings.



NEGRO MONKEY.

The budeng is found in great abundance in the forests of Java; it forms its dwelling on trees, and associates in numerous societies. Troops, consisting of fifty individuals and upwards, are often found together. In meeting them in the forests, it is prudent to observe them at a distance. They emit loud screams on the

approach of a man, and by the violent bustle and commotion excited by their movements, branches of decayed trees are not unfrequently detached, and thrown down on the spectators. They are often chased by the natives for the purpose of obtaining their fur. In these pursuits, which are generally ordered and attended by the chiefs, the animals are attacked with cudgels and stones, and cruelly destroyed in great numbers. The skins are prepared by a simple process, which the natives have acquired from the Europeans, and they conduct it at present with great skill. It affords a fur of a jet-black color, covered with long silky hairs, which is usually employed, both by the natives and by the Europeans, in preparing riding equipages and military decorations."

THE CRESTED LUTONG (*Semnopithecus cristatus*)

The crested lutong of Sumatra and Borneo is closely allied to the negro monkey, from which it appears to be chiefly distinguished externally by the blackish fur being usually grizzled, or washed with grayish-white. A male obtained by Sir Stamford Raffles in Sumatra, and presented by him to the Indian Museum (now dis-established), is described by Dr. Anderson as of a brownish-black color, with a fuliginous tinge on the flanks, fore-arms, and crest; the short crest on the vertex of the head being directed backwards, and the long black hair on the temples coming forwards. The same writer describes a female as black, with the tips of the hairs on the head and body of a lustrous gray tint; the hair of the limbs being yellowish-gray, except on the hands and feet, where they are black. On the under parts the hair is paler, with yellowish-gray tips; while the tail is black, tipped with gray above but yellowing underneath, more especially near the root. The face has a bluish-black hue.

THE NILGIRI LANGUR (*Semnopithecus johni*)

With the Nilgiri langur we come to the first of a large group of langurs, in which the hair of the crown, instead of radiating from one or more points on the forehead, is uniformly directed backwards without any trace of parting.

This species, which derives its Latin name from a former member of the Danish factory at Tranquebar in Madras, belongs to a subgroup characterized by the absence of a crest of hair on the crown of the head; the hair of the crown itself being not longer than that on the temples and the nape of the neck. The Nilgiri langur is a comparatively small species; the length of the head and body varying from about 21 to 23 inches, and that of the tail from 32 to 35, though larger individuals are occasionally met with. The hair of the body is long, fine, and glossy, and the general color black to blackish-brown, with the exception of the head and rump, of which the former is brownish-yellow, and the latter ashy-gray. The young of this monkey are black throughout, and this appears to be the case in the next species. The characteristic serves, therefore, to distinguish these langurs very markedly from those of the preceding group, in which, as we have seen, the young are light colored; and it may be taken as an indication that the present group is the most specialized of all

the langurs, not only having acquired the black tint in the adult, but even in the earlier stages of their existence.

As its name implies, it is found in the Nilgiri Mountains (or Hills as they are commonly called by Anglo-Indians) of Southern India, and its range extends from the Wynaad southwards to Cape Comorin.

According to Mr. W. T. Blanford, this langur "is shy and wary, the result of human persecution. It inhabits the *sholas*, or dense but abruptly limited woods of the Nilgiris, and other high ranges of Southern India, and is also found in the forests on the slopes of the hills, usually in small troops of from five to ten individuals. It is very noisy, having a loud guttural alarm-cry, used also to express anger, and a long loud call. Jerdon relates that when the *sholas* of the Nilgiri range were beaten for game, these monkeys made their way rapidly and with loud cries to the lowest portion, and thence to a neighboring wood at a lower level. In consequence of the beauty of their skins, and the circumstance that certain castes eat their flesh, these monkeys are more frequently shot than most of the Indian species, hence their shyness."

THE PURPLE-FACED MONKEY (*Semnopithecus cephalopterus*)

The purple-faced monkey is the representative of this group in the island of Ceylon. It is known to be liable to considerable variations of color, and at least, in a popular work like the present, we may follow Dr. Anderson in regarding the Singalese langurs known as the white monkey (*S. senex*), and the bear monkey (*S. ursinus*) as nothing more than well-marked varieties of this species.

There is a ready means of distinguishing the purple-faced monkey from the Nilgiri langur. In the latter the cheeks are of the same brown color as the rest of the head, in the former they are always much paler than the crown. Typically this species is of small size, the length of the head and body being only 20 inches, and that of the tail 24½ inches. The so-called bear monkey is, however, somewhat larger; the length of the head and body being 21, and that of the tail 26 inches. In color the typical purple-faced monkey varies from dusky- to smoky-brown and black, more or less tinged with gray on the back and upper parts, this gray being always present on the haunches. In the head the long whiskers on the cheeks stand out in striking contrast to the brown hue of the rest of the head. Some varieties are more decidedly brown; and in the bear monkey dusky-brown is the prevalent hue, with complete absence of the gray on the haunches. The white monkey, which we are disposed to regard merely as a variety of this species, is a curious-looking animal, being of a general yellowish-white color, with a faint brownish tinge on the head, and tending to a dusky hue on the shoulders and down the middle of the back. The face and ears retain the usual black color, but the palms of the hands and the soles of the feet are flesh colored.

The typical form is found over the greater part of Ceylon at low or moderate elevations, and apparently not ascending above some thirteen thousand feet above the sea level. The bear and white monkeys are, however, confined to the southern

parts of Ceylon, and ascend to much greater elevations; the former variety being especially abundant in the high mountains in the neighborhood of the town of Newera Ellia.

Mode of Life Sir Emerson Tennent, writing of the typical purple-faced monkey, which he terms the wanderu of the low country, says that it is far the commonest of the Singalese langurs, and that, "It is an active and intelligent creature, little larger than the common bonneted macaque, and far from being so mischievous as the other monkeys in the island. In captivity it is remarkable for the gravity of its demeanor, and for an air of melancholy in its expression and movements which are completely in character with its snowy beard and venerable aspect. In disposition it is gentle and confiding, sensible in the highest degree of kindness, and eager for endearing affection, uttering a low plaintive cry when its sympathies are excited. It is particularly cleanly in its habits when domesticated, and spends much of its time in trimming its fur, and carefully divesting its hair of particles of dust. Those which I kept at my house near Colombo were chiefly fed upon plantains and bananas, but for nothing did they exhibit a greater partiality than the rose-colored flowers of the red hibiscus. These they devoured with unequivocal gusto; they likewise relished the leaves of many other trees, and even the bark of a few of the more succulent ones."

After referring to the white monkey, which he regards as merely a variety of the lowland wanderu, Sir Emerson Tennent proceeds with his account of the latter, and states that, "When observed in their native wilds, a party of twenty or thirty of these creatures is generally busily engaged in the search for berries and buds. They are seldom to be seen on the ground, except when they may have descended to recover seeds or fruit which have fallen at the foot of their favorite trees. When disturbed, their leaps are prodigious; but, generally speaking, their progress is made not so much by leaping as by swinging from branch to branch, using their powerful arms alternately; and, when baffled by distance, flinging themselves obliquely so as to catch the lower boughs of an opposite tree, the momentum caused by their descent being sufficient to cause a rebound of the branch, that carries them upward again till they grasp a higher and more distant one, and thus continue their headlong flight. In these perilous achievements wonder is excited less by the surpassing agility of these little creatures (frequently encumbered as they are by their young, which cling to them in their career) than by the quickness of their eye and the unerring accuracy with which they seem almost to calculate the angle at which a descent will enable them to cover a given distance, and the recoil to attain a higher altitude."

The same writer then goes on to say that in the hills the typical black form of this monkey is replaced by the so-called bear monkey. "The natives, who designate the latter as the Maha, or Great Wanderu, to distinguish it from the Kala, or Black one (the typical purple-faced monkey), with which they are familiar, describe it as much wilder and more powerful than its congener of the lowland forests. It is rarely seen by Europeans, this portion of the country having till very recently been but partially opened; and even now it is difficult to observe its

habits, as it seldom approaches the few roads which wind through these deep solitudes. At early morning, ere the day begins to dawn, its loud and peculiar howl, which consists of a quick repetition of the sounds *how, how!* may be frequently heard in the mountain jungles, and forms one of the characteristic noises of these lofty situations." There is a record of one of these monkeys having attacked a native laden with a bag of rice.

THE CAPPED LANGUR (*Semnopithecus pileatus*)

Of somewhat smaller dimensions than the hanuman is the capped langur of Assam and the neighboring districts of Northeastern India and Upper Burma. This species may be readily distinguished from the Nilgiri langur and the purple-faced monkey (with its varieties) by the hair of the crown of the head being longer than that on the occiput and temples, thus having somewhat the appearance of a cap, from which character the species derives its name.

In color this monkey varies from a dusky-gray to a brownish ashy-gray on the upper parts; the upper part of the back, and sometimes also the crown of the head, being darker. The hands and feet are dark or black above, but occasionally some or all of the fingers may be yellowish. The tail is dark brown, but may be black at the tip. The face is always black, but the sides and lower parts of the head, as well as the neck, vary from a golden brown or orange to a pale yellow or yellowish-white tint. The light color of the sides of the face extends backwards to a line just above the ears, so that, with the light-colored nape of the neck, the dark cap is well defined, and gives to this monkey a peculiar and distinctive appearance.

According to Mr. Blanford, nothing is known of its habits in a wild state, although they are probably very similar to those of most of the other species of the genus. In captivity it is said to be gentle if captured when quite young, but if not taken till adult it is morose and savage, this being especially the case with old males.

The so-called red-bellied langur (*S. chrysogaster*) is only known by an adult female and a young one preserved in the Museum at Berlin, and reputed to have been obtained from Tenasserim. In the adult the upper parts, the limbs, and the tail are jet black, with the lower portions of the individual hairs ruddy, and their extreme bases white; the band on the forehead, as well as the cheeks to behind the ears, and the sides and front of the neck, together with the chin and the upper part of the breast are pure white. The remainder of the under parts are of a deep bright ferruginous red, which also tinges the inner sides of the limbs, and gives the animal its distinctive appellation. The young are of a uniform reddish-white color. The head of the adult appears to have a small crest, and by this it is distinguished from the typical capped langur.

From this description it would appear that this monkey is the most brilliantly colored of all the langurs; and Mr. Blanford considers from this circumstance that if it really comes from Tenasserim other examples ought ere this to have been obtained. Dr. Anderson regards this monkey merely as a brilliantly colored variety of the capped langur, but this view is not accepted by Mr. Blanford.

THE DUSKY LEAF-MONKEY (*Semnopithecus obscurus*)

The dusky leaf-monkey, which is found in Siam, the Malay Peninsula, and the Tenasserim provinces, while agreeing with the Nilgiri and the capped langur in the backward direction of the crown of the head, is distinguished by the possession of a distinct crest of longer hairs on the occiput, arranged in a pointed form.

The adult of this langur is of comparatively small size, the length of the head and body measuring 21 inches, and that of the tail 32. Usually the general color of the head, body, and limbs is dark, ashy gray, but it may vary to blackish-brown. The under parts and tail are generally lighter, but the hands and feet are black. The crest on the back of the head is always distinctly lighter than that of the rest of the crown, and may be almost white. The young are of a bright golden ferruginous color. According to Mr. Blanford this species is known to the Malays as *Lutong itam*, a title which appears properly to belong to the black variety of the negro monkey.

Closely allied to this species is Phayre's leaf-monkey (*S. phayrei*), distinguished by the crest of hair being placed on the crown of the head instead of on the occiput, and by this same crest being compressed and longitudinal, instead of pointed; while the color of the body is dark gray above, and whitish underneath. Phayre's leaf-monkey inhabits Arakan, part of Pegu, and Northern Tenasserim.

Writing of this species, Mr. Blanford states that it "is found in dense, high forests, or amongst bamboos on the hillsides and on the banks of streams, usually in flocks of twenty or thirty individuals. It is very shy and wary, and is consequently more often heard than seen; the whole flock when alarmed rushing through the forest, shaking the branches violently, and leaping from tree to tree. But occasionally, as Tickell observes, an old male stays behind in a safe post of vantage on the top of one of the highest trees, where he may be heard uttering his short, deep alarm-cry at frequent intervals. This cry is an angry bark, not unlike that of the hanuman. I was once well scolded from a tree by an old monkey, I believe of this species, on the edge of a half-deserted clearing in Southern Arakan. I had done nothing to offend his monkeyship, but he evidently considered me as something unusual and suspicious. Blyth observes that the young, besides making a whining noise to express their wants, emit a cry that might be mistaken for the mew of a cat."

HOSE'S LANGUR (*Semnopithecus hosei*)

This very handsome and peculiarly-colored langur from Borneo belongs to the group in which the hair of the crown extends evenly backwards. It is about the same size as the dusky leaf-monkey. The crown has a longitudinal crest, starting about half an inch behind the centre of the forehead. The general color of the body is a hoary gray, caused by the mixture of black and white hairs. The crest, as well as the centre of the crown of the head, the nape of the neck, and the eyebrows, are of a deep glossy black, and the hands and feet are of the same jetty hue. In marked contrast to these sombre tints is the brilliant white of the forehead,

temples, sides of the head and neck, and chin. This white is continued down the throat and chest to the under surface of the body, and the inner sides of the upper parts of the limbs.

This exceedingly handsome species differs from all the langurs yet mentioned, in the marked contrast presented by its black crest to the brilliant white of the temples and cheeks. A specimen was obtained by Mr. John Whitehead on Kina Balu, the great mountain of Borneo, at an elevation of some four thousand feet above the level of the sea; and this explorer states that the species is fairly common in certain patches of forest on the mountain and in its neighborhood.

The reader might well be excused for thinking that with this he had reached the end of the already long list of langurs; but there are several other species more or less closely related to those we have mentioned. As, however, even the enumeration of these might be wearisome, we pass on to the consideration of

THE DOUC (*Semnopithecus nemæus*)

The douc, or variegated langur, is an inhabitant of the forests of Cochin-China, where it is found near the coast, as well as in the interior, and is remarkable for its brilliant coloration. There seems to be great doubt as to the origin of the name Douc, which was applied to this monkey by Buffon, and it is stated to be unknown

in Cochin-China; it has, however, been so long in use that there would be no advantage gained by changing it.

The general form of the douc is so different from that of other langurs, that the late Dr. Gray proposed to make it the type of a distinct genus. Thus the general build is more robust, and the limbs are stouter, and of nearly equal lengths; whereas in the typical langurs the arms are considerably shorter than the legs.

The hair on the top of the head is directed backwards, without any crest, and the brilliant white whisk-



THE DOUC.

ers have likewise the same direction, and are closely pressed to the face. The general color of the head is brown, but there is a narrow band of bright chestnut passing backwards under the ears, and the naked face is of a brilliant yellow, which makes a bold contrast to the pure white whiskers. Owing to the hairs of the body having alternate dark and light rings of color, the general tint of the body is a mottled, grizzled gray, darker on the upper than on the under parts. The upper parts of the arms and legs, as well as the hands and feet, are of a deep black; but the lower legs are of a full chestnut, and the fore-arms white. A large patch

on the rump near the root of the tail, as well as the tail itself, are likewise white. All these colors are extremely brilliant, and sharply defined, without any tendency to blend with one another at their junctions, so that this monkey is one of the most gorgeously colored Mammals known.

We have very little information as to the habits of the douc in a state of nature, and it does not appear that it has been exhibited alive (at least of late years) in this country. M. Rey, a French captain, who visited Cochin-China in the years 1819 and 1820, has given us an account of a number of doucs which he saw during an expedition into the interior of the country, in the course of which it is stated that a hundred individuals were slaughtered on a single occasion in the endeavor to capture some living specimens.

THE TIBETAN LANGUR (*Semnopithecus roxellanae*)

Perhaps the last place in which we should expect to find a living monkey would be the highlands of Eastern Tibet. Nevertheless, that one—and a very peculiar one—does exist in those elevated regions has been proved by the researches of the French missionary, Abbé David, who has done so much to increase our knowledge of the fauna of that inaccessible part of the world. The monkey in question, which may be known as the Tibetan langur, although a true *Semnopithecus*, may be recognized at a glance among all its congeners by its "tip-tilted" nose. Although short and small, the nose is so much turned up that its tip reaches to the level of the lower border of the eyes. Some writers, relying on this peculiar formation of the nose, have separated the species from the other langurs under the name of *Rhinopithecus*, but this multiplication of generic terms is confusing and unnecessary.

Although this remarkable monkey was first made known in Europe from specimens obtained in Eastern Tibet, subsequent researches have shown that it also ranges into Northwest China, where it is found on the mountains of the province of Kansu. It appears, indeed, from the researches of the late Professor Moseley, that it has been known to the Chinese for an immensely long period. There is a Chinese work known as the *Shan Hoi King*, or mountain and ocean record, of very great antiquity,—so old indeed, that one commentator even assigns to it as early a date as the year 2205 B.C.,—in which there is a woodcut representing a man of the Heu Yeung Kingdom, wherever that may be. Professor Moseley reproduces this figure in his *Notes of a Naturalist on the "Challenger,"* and says that it evidently represents a monkey closely allied to, and perhaps identical with, the species under consideration; the prominent nose turned up at the tip being clearly shown in the engraving. Professor Moseley adds that "the wide but unscientific distinction commonly drawn between men and the higher monkeys is an error of high civilization, and comparatively recent. Less civilized races make no such distinction. To the Dyak the great ape of Borneo is simply the Man of the Woods—orang-outang." The Tibetan langur differs from the Indian langurs by its stouter build, and relatively shorter limbs. The upper surface of the body, the crown of the head, the outer sides of the limbs, and the whole of the tail, are an olive-brown color, flecked with yellow; while the sides of the face, the lower part of the forehead, and all the

under parts and the inner sides of the limbs, are of a brilliant yellow, tending to orange, the naked parts of the face being bluish-gray.

These langurs inhabit the forests of the mountain region between Moupin and Lake Khokonor, where snow is said to lie for a large portion of the year. They are stated to live in numerous troops, always ascending the loftiest trees, and feeding on fruits, but when pressed by hunger eating also the leaves and shoots of the bamboo.

FOSSIL LANGURS

As we might naturally suppose would be the case, fossil remains of langurs have been found in their native land of India. Some of these have been obtained from caverns in the Madras Presidency, and do not date back much, if at all, beyond the human period. Other remains occur, however, in the much older Siwalik sandstones forming the ranges on the flanks of the Himalayas, and belonging to the upper part of that division of the Tertiary period known to geologists as the Pliocene. This does not, however, by any means limit the range of extinct langurs, since their remains have been found in the Pliocene deposits of the Val d'Arno in Tuscany, and also in strata of equivalent age in the south of France. We have, therefore, evidence that these monkeys, which are now confined to the Oriental region, were formerly widely spread over the Eastern Hemisphere.

THE PROBOSCIS MONKEY

Genus *Nasalis*

If the physiognomy of the Tibetan langur strikes us as ludicrous, it is hard to say what epithet we ought to apply to the far more grotesque-looking creature represented in the accompanying figure. The nose of the proboscis monkey is indeed so enormous in proportion to the face that it presents the appearance of an absolute deformity, and it is very hard to imagine of what possible advantage it can be to its owner.

The proboscis monkey (*N. larvatus*) is an inhabitant of Borneo, and its marked difference from other monkeys is one of many proofs indicating the great antiquity of that island, and the long period during which it has been isolated from other lands. In general structure the proboscis monkey conforms so closely to the langurs that the peculiarity of its nasal organ would not alone justify its separation from that group as the representative of a distinct genus, although it was on this ground alone that the separation was originally made. Subsequent researches have, however, shown that the skull can be distinguished at a glance from that of any of the langurs, and also from those of the African genus *Colobus*, to be mentioned immediately, by the form of the aperture of the nasal cavity. Thus, whereas in the latter this aperture extends upwards between the sockets of the eyes, in the proboscis monkey the nose bones which roof over this aperture descend considerably below

the lower margin of the eye sockets. In this respect the species under consideration resembles the macaques and their allies.

The proboscis monkey was first made known to European science in 1781 by Baron Wurmb, sometime Dutch governor of Batavia. Wurmb described it under the name *Kahau*, a term apparently made up from a resemblance to its cry, but unknown to the native inhabitants of Borneo, by whom it is said to be called Bantajau. Specimens were subsequently sent to Europe by Sir Stamford Raffles, and it was considered by Messrs. Vigors and Horsfield that these indicated two distinct



THE PROBOSCIS MONKEY.
(One-tenth natural size.)

species; but it was afterwards discovered that these supposed two species were founded upon the male and female of the one and only proboscis monkey, in which the two sexes differ considerably in point of size.

The proboscis monkey is a rather large animal, the combined length of the head and body of the male being about 30 inches, while the tail measures some 27 inches. The general color is a kind of ochre yellow, the head and upper parts of the body being chestnut. The under parts are lighter; a large patch on the rump above the root of the tail, as well as the tail itself, together with the fore-

arms and lower legs, being grayish-yellow. The forehead is very low, and the dark chestnut hair is directed backwards from a nearly straight line immediately over the eyes; while the hair of the temples is continued down the sides of the face as whiskers, which meet as a beard beneath the chin. The whole of the large naked face is, therefore, surrounded by a hairy frame. In stuffed or dried specimens the skin of the face fades to a dull leaden hue; but when the animal is alive the tint is of a reddish-brown flesh color.

The light-colored area on the loins near the root of the tail usually takes the form of a number of large rectangular spots, producing a very peculiar and characteristic kind of coloration, which is, however, absent in the female.

The enormous nose, from which the proboscis monkey derives both its popular and scientific appellations, projects several inches in front of the mouth, with the nostrils placed on its under surface, although separated by a much narrower septum than in man. This excessive development of the nose is, however, only reached in the adult male; it being much less throughout life in the female, while in the young of both sexes it is comparatively small, and upturned as in the Tibetan langur.

No living examples of the proboscis monkey have, we believe, been exhibited in England, and accounts of its habits in the wild condition are few. The following extracts are taken from a translation of the original account given by Baron Wurmb. After stating that these monkeys are found in large troops, the author says that, "They assemble together morning and evening, at the rising and setting of the sun, and always on the banks of some stream or river; there they may be seen seated on the branches of some great tree, or leaping with astonishing force and rapidity from one tree or branch to another, at the distance of fifteen or twenty feet. It is a curious and interesting sight; but I have never remarked, as the accounts of the natives would have you believe, that they hold their long nose in the act of jumping; on the contrary, I have uniformly observed that on such occasions they extend the legs and arms to as great a distance as possible, apparently for the purpose of presenting as large a surface as they can to the atmosphere. The nature of their food is unknown, which renders it impossible to keep them alive in a state of confinement."

THE THUMBLESS MONKEYS

Genus *Colobus*

The langurs, which as we have seen are widely distributed over Southeastern Asia, and more especially that portion forming the Oriental Region of zoologists, are replaced in Africa by a group of monkeys closely allied to them in all respects, but distinguished either by the total absence, or rudimentary condition, of the thumb. When present at all this digit merely takes the form of a small tubercle, which may or may not be provided with a minute nail. Such a point of difference from the langurs is rightly regarded as worthy of generic distinction, and these

African monkeys have accordingly been described under the name of *Colobus*, in allusion to the feature in question. There is no popular name by which these monkeys are generally known, and we have accordingly entitled them the Thumbless Monkeys. Since, however, this term would be somewhat cumbersome when prefixed to another denoting the various species, it has been usual to anglicize the scientific name *Colobus*.

There are rather less than a dozen species of this group known to science. Our acquaintance with their habits is, however, extremely imperfect, and few of them have been brought alive to Europe, since, like their cousins the langurs, they are delicate, and do not thrive well in confinement. The sacculated stomach indicates that their food, like that of the langurs, is in all probability largely composed of leaves and twigs. If, however, their habits at all resemble those of the group last mentioned, it is not easy to see why they should have lost their thumbs, —unless, indeed, the small thumbs of their Indian cousins are practically useless.

In addition to being strictly African, all the thumbless monkeys, with one exception, appear to be confined to the west coast, where they must be very abundantly represented. Most of them are remarkable for the length and beauty of the silky hairs with which their bodies are clothed; their fur being largely imported into Europe for use as trimming for other furs and various kinds of apparel.

Our imperfect acquaintance with this group in their native haunts must be largely attributed to the neglect with which travelers and sportsmen treat monkeys and baboons. In every book of travel or sport we are sure to find chapter after chapter devoted to the hoofed Mammals and the carnivores, but very seldom is there a word about monkeys. We have no desire to place any check on the continuous flow of information relating to any of the animals, but we venture to put in a plea that at least some attention may be devoted to these when opportunity offers.

Before noticing some of the species of this group it may be mentioned that the hair of all the thumbless monkeys is colored uniformly, and by this character even a small piece of their fur may be distinguished from that of all other African monkeys, in which each individual hair is ringed with different hues.

THE GUEREZA (*Colobus guereza*)

We commence our account of the thumbless monkeys with this strikingly handsome animal, which differs so much in external appearance from the other members of the group that it was referred by Dr. Gray to a distinct genus.

It is commonly reported to inhabit Abyssinia, but Mr. Blanford, who accompanied the Abyssinian Expedition under Lord Napier of Magdala, states that he never heard of the animal in the part of the country traversed by the army, and that the skins which are often offered for sale to travelers at Aden are really brought from the mountains in the interior of Somaliland. As, however, Somaliland and Abyssinia are contiguous, it is highly probable that it may be found on the eastern borders of the former; and that it is found in Central Abyssinia in

the neighborhood of Samen, we have the evidence of several of the earlier travelers to prove. In Southern Abyssinia it appears to be of comparatively common occurrence in the district of Gojam, and thence it extends further to the southward into the Galla country. From the Galla country and Somaliland the guereza appears to range to the southwest into the Niam-Niam district, lying to the northwest of Lake Albert Nyanza, and to the southward as far as Kilima-Njaro on the east coast.

The head, body, and limbs of the guereza are covered with jet black hair of moderate length; but on either side of the back there arises a line of long hair, hanging down below the flanks, and forming a kind of mantle of a pure white



THE GUEREZA MONKEY.
(One-tenth natural size.)

color. The dark face is also surrounded with a fringe of the same white hair, which forms long whiskers lying flat on the cheeks, and directed backwards. The long tail terminates in a white tuft. The contrast of the white of the mantle, cheeks, and tail against the velvety black of the rest of the body is most striking and without exact parallel among other Mammals, although the coloration of the skunk is somewhat suggestive of it.

Handsome as is the ordinary guereza in these respects, it is, however, exceeded by a variety occurring commonly at an elevation of about three thousand feet on the flanks of Kilima-Njaro, while the common race is believed to exist in the plains around. In the common guereza the first 12 or 16 inches of the tail are

black and short haired, the white tufted portion including only the last 8 or 10 inches; while the white mantle of hair depending from the back conceals only about one-third of the black portion of the tail. In the Kilima-Njaro variety, or large-tailed guereza, only some 3 or 4 inches of the base of the tail are black and short haired, while the remainder is covered with long white hair for a length of some 20 inches, each individual hair measuring from 8 to 9 inches. Moreover, the white hairs of the mantle entirely conceal the black of the root of the tail, so that the mantle and tail-brush practically become continuous. The tail of this variety reminds us of the larger tail of half-bred yaks used in India as fly flappers, under the name of *chowris*; and indeed the whole arrangement of the long hairs of the guereza, as well as its coloration, recalls a half-bred yak.

The guereza has never been brought alive to this country. One of the earliest accounts of its habits is given by Pearce in his *Life and Adventures in Abyssinia*, in which it is stated that guerezas are common to the Galla country, and that while they are known in the Amharic dialect of Central Abyssinia under the name of Focha, in the Tigré tongue they are called Grazer (=Guereza). At this period, and even up to the date of Salt's second journey into Abyssinia in the first quarter of this century, these animals were supposed to be a species of lemur. Rüppell, however, definitely assigned the guereza to its proper zoological position, and has left us an account of its habits, from which the following particulars are taken.

The guereza is said to live in small companies, and usually inhabits the tallest trees it can find in the neighborhood of running water. It is restless, and constantly on the move, but is said to be completely silent. The leaps which it takes from tree to tree are described as of tremendous length. It subsists mainly on various kinds of wild fruits, seeds, and insects, and it spends the whole day in collecting these, retiring to sleep high up in the trees. In Gojam, on the southern frontier of Abyssinia, it is common; and it is largely hunted for the sake of its fur, which is used for covering the shields of the Abyssinian soldiers.

There are good grounds for believing that this monkey is the true callithrix of the ancients, although this name is now applied in zoology to a totally different group of monkeys, as we shall see below.

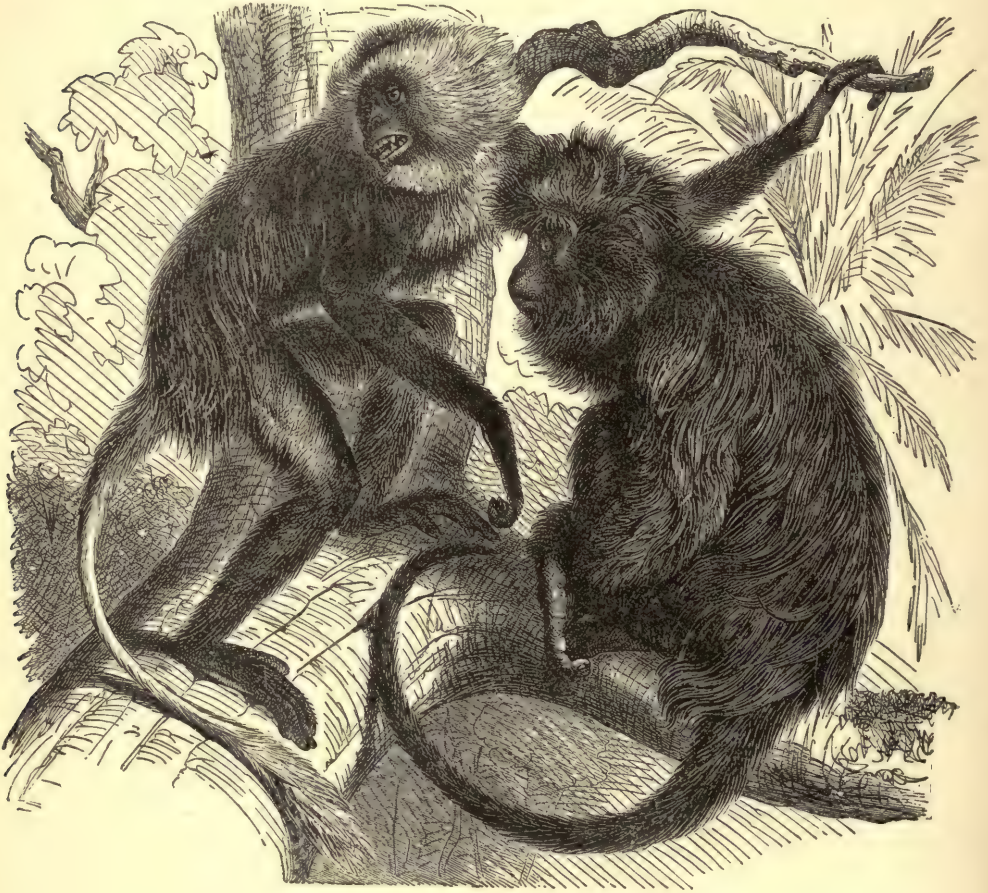
THE BLACK COLOB (*Colobus satanas*)

In marked contrast to the pied coloration of the preceding species is the sable hue of the black colob, first described from specimens obtained at Fernando Po, on the West Coast of Africa, in 1838.

The uniform black color of this monkey, of which a representation is given in the right-hand figure of the cut on p. 88, suffices indeed to distinguish it at once from all its congeners. In addition to this black coloration, the crown of the head has a crest of long hair projecting over the temples and eyes, and the whiskers are long and expanded. The whole of the body is covered with long and rather coarse hair; but the tail is short-haired throughout the greater part of its length, and has no trace of a tuft at the end. The whole of the hair has a dull and

shaggy appearance, recalling, as an earlier writer has observed, that of the sloth bear of India. The length of the head and body is 32 inches, while that of the tail reaches 40 inches.

Although this species is mentioned by Du Chaillu as inhabiting Western Equatorial Africa, it is to be regretted that we have no record of its mode of life.



THE URSINE COLOB AND BLACK COLOB.
(One-eighth natural size.)

THE KING MONKEY (*Colobus polycomus*)

The king monkey of Sierra Leone is one of the few colobs that have been exhibited alive in the Gardens of the London Zoological Society, a single specimen having been purchased in the spring of 1873. It has no crest on the head, but a long mane on the throat and chest, the hair of the sides of the body being likewise long. The general color is black, but the mane, the forehead, and the sides of the face, as well as the whole of the tail, are of a dazzling white. The tail has a well-marked tuft at the end, and the entire coat of hair is very glossy.

THE URSINE COLOB (*Colobus ursinus*)

Closely allied to the last species is the so-called ursine colob from Fernando Po, in which the mane is grayish, and not longer than the hair on the sides of the body. Yet another nearly related West African monkey is the Angola colob (*Colobus angolensis*), which differs from the king monkey in that the chest and two-thirds of the lower portion of the tail are black.

THE WHITE-THIGHED COLOB (*Colobus villerosus*)

More markedly distinct than the preceding from the king monkey, is the white-thighed colob of Western Africa. This species is distinguished by the absence of a mane on the head and throat, although it has a small fringe round the face. The general color is glossy black, but that of the forehead, of the frill round the face, and on the chin, is white. The tail is also white, but the most distinctive characteristic of the species is the silvery-white of the thighs, from which it derives its name. The haunches are, moreover, generally gray. The white hair of the thighs is shorter than that on the body.

THE BAY COLOB (*Colobus ferrugineus*)

Very different in coloration from any of the species yet mentioned is the bay colob, definitely known from the Gambia and the Gold Coast, and of which a single specimen was brought alive to England in the autumn of 1890, but, unfortunately, did not long survive its arrival.

This handsome species has comparatively short hair, which, on the crown of the head and the back and upper part of the sides is blackish-gray, while the cheeks and throat, as well as the under parts and the limbs, are of a rich ferruginous bay. The upper part of the root of the tail is blackish, but the remainder of a reddish-brown. The ears and the greater part of the face are bluish, but the nose and lips are flesh colored. Altogether the bay colob is a striking species, which, once seen, will always be easily recognized.

THE CRESTED COLOB (*Colobus cristatus*)

The last of the thumbless monkeys we shall mention is the crested colob, which is likewise a West African species. It is readily distinguished by its short yellowish-brown fur, which becomes grayer on the front of the body; the shoulders and outer sides of the arms, the throat, chest, under parts, and inner sides of the limbs being grayish-white. It differs from all the other species in that the hair on the forehead radiates from two points on the temples, and that there is a low erect crest of longer hairs running along the middle line of the head.

CHAPTER IV

APES, MONKEYS, AND LEMURS—*continued*

THE OLD WORLD MONKEYS AND BABOONS—*continued*

IN the preceding chapter we have considered such of the Old World monkeys as have no cheek pouches, but possess sacculated stomachs, and in which the legs are longer than the arms. In systematic zoology these constitute the subfamily *Colobinæ*, of the family *Cercopithecidae*. We have now to consider the remainder of the Old World monkeys, together with the baboons, which, although belonging to the same great family, constitute the separate large subfamily of the *Cercopithecinae*. This group is characterized by the circumstance that all its members are furnished with cheek pouches, but their stomachs are simple, and the arms and legs are of nearly the same length.

THE GUENONS

Genus *Cercopithecus*

Since we have no English name to distinguish this group of African monkeys from others of the same family, it will be found convenient to use the French name *Guenon*, meaning one who grimaces, which appears to have been especially applied to the monkeys of this group, as being those with which we are most familiar in menageries and shows.

As we have said, these monkeys are strictly confined to Africa, where they are represented by more than twenty species, of which the larger proportion are found on the western side of the continent. None of them are of large size, and they present the following features by which they are characterized as a genus.

Characteristics In build they are comparatively slender, and their muzzle is either short, or at least not very long. Their tail is invariably long and slender, and the naked callosities on the buttocks are of comparatively small size. For another important point of distinction we must have recourse to the dried skulls, an examination of which will show that the last molar or wisdom-tooth on each side of the lower jaw consists of four tubercles only, and of these the front and hind pairs are connected by a pair of transverse ridges. In this respect the guenons differ, not only from the monkeys described in the last chapter, but likewise from all those to be subsequently noticed, in which the last lower molar has a fifth tubercle forming a kind of heel projecting from behind the second transverse ridge.

In general appearance, more especially as regards their slender build and long tails, the guenons are the members of the present subfamily which make the nearest approach to the langurs and their allies. All of them, like the other African monkeys to be subsequently mentioned, are characterized by each individual hair being marked by a series of different-colored rings, which imparts to the fur the peculiar mottled appearance with which we are familiar.

In disposition these monkeys are docile and easily taught, and so well do they thrive in captivity that it is not uncommon for them to breed in menageries. In consequence of this docile disposition, and their comparatively hardy constitution, as well as from the facility with which they learn tricks, and to obey the word of command, they, or the representatives of the next genus, are generally chosen as companions by the peripatetic organ-grinders. Mischievous as a monkey, is truer of the guenons than of any other members of the order to which they belong; and it is largely to them that the monkey-house at the Zoological Society's Gardens owes its popularity.

Mode of Life Like the langurs, the guenons are essentially arboreal, and they are found in their native wilds in large troops, which reveal their proximity by their incessant chattering. Not only, therefore, is the solitary monkey of the London organ-grinder to be commiserated for having exchanged the sunny atmosphere of his native African forests for the gloom of an English winter, but likewise for the loss of the merry companions with which he was wont to associate.

In saying that the guenons are docile, we should guard ourselves by adding, docile for a monkey, since in the strict sense of the word all monkeys are far less docile and less susceptible of education than many other Mammals. This, however, by no means implies that monkeys have not a very high degree of intelligence. In regard to this point we may quote a very suggestive paragraph from Mr. Blanford. "It is the commonest mistake," he writes, "amongst superficial observers, and even amongst naturalists, to confound docility and intelligence among animals, and to measure their intellectual powers by the facility with which they can be taught. Hence the very common, but, as it appears to me, very incorrect notion, that monkeys are of inferior intelligence to such animals as dogs and elephants. In reality they are less docile, less willing to learn, and less adapted to captivity; moreover, being of but little use to man, far less trouble has been taken in studying their habits. Thus while dog and elephant-breaking engage all the time and mental resources of particular classes of men, the instruction of monkeys is left to the unaided efforts of amateurs and organ-grinders. The negro race amongst men appears to be far better adapted for slavery than most savage races, being more docile in a state of captivity; but it is scarcely proved to be more intelligent on that account. The same reasoning will doubtless apply to animals. I have often seen dogs and monkeys kept together, and in every instance it has appeared to me that the monkey ruled the dog, and that the dog, although the more powerful animal, feared the monkey; and I can only account for this by the superior intelligence of the monkey."

In their native condition the guenons go in separate families or droves, each under the leadership of an old male; and it appears that each drove has its own particular limits of territory beyond which it cannot go without intruding on the domains of another drove, an invasion which is treated as at once being a *casus belli*. Indeed, this principle of territorial rights appears to be so deeply implanted in the guenon nature that it persists even in captivity, when it is no uncommon sight to see two or more of these creatures religiously guarding one portion of the cage from all intruders.

In Ancient Egypt As being the common monkeys of Africa the guenons would naturally be well known to the ancient Egyptians; and it is probable that most of the long-tailed monkeys we see on their old sculptures are either guenons, or mangabeys, as the members of the next group are called. The thumbless monkeys, as being almost exclusively West African, would be less likely to be intimately known to the inhabitants of Egypt. Not only were the guenons familiar to the Egyptians, but they appear to have been likewise imported into classic Greece and Rome; and it is believed that the Greek and Latin term *Cebus* was used to designate them, although the name is now applied to a South American genus.

THE TALAPOIN MONKEY (*Cercopithecus talapoin*)

The somewhat rare and tiny monkey from the Gabun and other regions of the West Coast of Africa is taken as our first example of the guenons, on account of the possession of a peculiarity which led Dr. Gray to separate it from all the others as the representative of a distinct genus (*Myopithecus*). This peculiarity is to be found in the circumstance that the last molar in the lower jaw has only three, in lieu of the ordinary four tubercles on its crown. Another distinctive feature, which can be observed in the living animal or in stuffed specimens, is the relative shortness of the hands as compared with those of the other guenons, and also the presence of a web uniting the bases of the fingers. The talapoin, which is scarcely larger than a squirrel, is the smallest of the guenons. In color it is olive green above and whitish beneath, with short whiskers of a pale golden yellow tint, forming a striking contrast to the face, which is black, with the exception of the upper lip and rings round the eyes, which are yellow or orange.

THE MALBROUCK MONKEY (*Cercopithecus cynosurus*)

With the malbrouck monkey of Western Africa we come to the first of a group of guenons characterized by their oval heads and somewhat long muzzles, as well as by their stiff and backwardly-directed whiskers. The fur is invariably grizzled, each hair being marked with greenish or reddish rings.

The malbrouck is distinguished from the other members of this group by the large and broad face being flesh colored. The general hue of the fur is yellow,



WEST AFRICAN GREEN MONKEYS.

grizzled with black; a distinct band on the forehead, as well as the whiskers, throat, the under parts, and the inner surface of the limbs being whitish.

The first specimen of this monkey exhibited alive in England is described as having an unusually mild and gentle expression of countenance, and was calm, circumspect, and inactive in its general habits. It did not, however, appear anxious to become at all familiar either with its keepers or with strangers, and was always ready to resent any interference with its liberty.

THE VERVET MONKEY (*Cercopithecus lalandi*)

Still better known than the malbrouck is the South African vervet monkey, or black-chinned vervet, as it has been called, in which, as in all other members of this group of guenons, the rather small and narrow face is entirely black or blackish.

The fur of the vervet is of a grayish-green color, finely speckled with black on the greater part of the body. The face, hands, and feet, and the terminal third of the tail, are of a deep black; while the cheek, throat, and under parts of the body are reddish-white, and the root of the tail and adjacent regions red. The band on the forehead is distinct, and yellowish. The red root and black tip of the tail and chin are absolutely distinctive of this species.

In size the vervet is somewhat smaller than the mona mentioned hereafter. With the exception of the samango monkey, it is the sole South African representative of the guenons. It is common in forest districts throughout the Cape Colony and adjacent regions, more particularly along the tract of coast extending from Cape Town to Algoa Bay, and thence through Kaffraria and Natal. It is said to feed chiefly on the gum from the acacias known to the Boers as camel-doorn and rhinaster-bosh, and its habits appear to be similar to those of the green monkey.

THE GRIVET MONKEY (*Cercopithecus griseoviridis*)

As the vervet is one of two of South African representatives of the guenons, so the grivet is one of two members of the group found in Northeastern Africa. In color the fur of this species is olive-green, speckled with yellow and black, while the chin, whiskers, and under parts of the body are white, and the root of the tail and adjacent regions gray. The forehead has a broad whitish band, but faintly marked. The white chin and gray root to the tail serve to distinguish this monkey from the vervet, with which it agrees in size.

Writing of the grivets in Abyssinia, Mr. Blanford observes that they are but rarely seen, and then only in forest. "On the highlands," he states, "I only once saw a flock—this was near Dildi, south of Lake Ashangi. I met with large numbers on the Anseba, where they inhabited the high trees on the banks of the stream. The flocks seen were small, not exceeding twenty to thirty individuals. I had but

few opportunities of observing their habits, but they appeared to differ but little from those of macaques, except that *Cercopithecus* is a quieter animal and less mischievous. In captivity they are well known as excessively docile and good-tempered, and fairly intelligent."

THE GREEN MONKEY (*Cercopithecus callitrichus*)*

One of the commonest of the guenons usually to be seen in menageries is the West African green monkey. The color of the fur may be described as a mixture of black and yellow, giving a general dark green hue to the upper parts, the crown of the head, the hands, feet, and the upper part of the root of the tail being blacker. There is generally no light band on the forehead, and if this be present it is very narrow. The whiskers, throat, and under side and end of the tail are yellowish, sometimes tending to orange; and as in the last species, the base of the root of the tail is gray.

This monkey, of which we give a representation in the illustration on p. 93, is closely allied to the grivet, from which it may be distinguished by the more yellow-green hue of its upper parts, the yellowish whiskers, and the general absence of the white band on the forehead.

The green monkey is about the size of a large cat, the length of the head and body being 16 or 18 inches, and that of the tail rather more. It is one of the hardiest of the guenons, on which account it is so frequently seen in confinement, as it bears our climate well. Although gay and gentle during youth, it usually becomes morose and vicious when old, and is therefore not one of the species usually selected for exhibition by traveling organ-grinders. Like the other members of the group, it does not appear that the green monkey ever utters a sound when in captivity, and from an early account of the species it appears to be similarly silent in its wild condition.

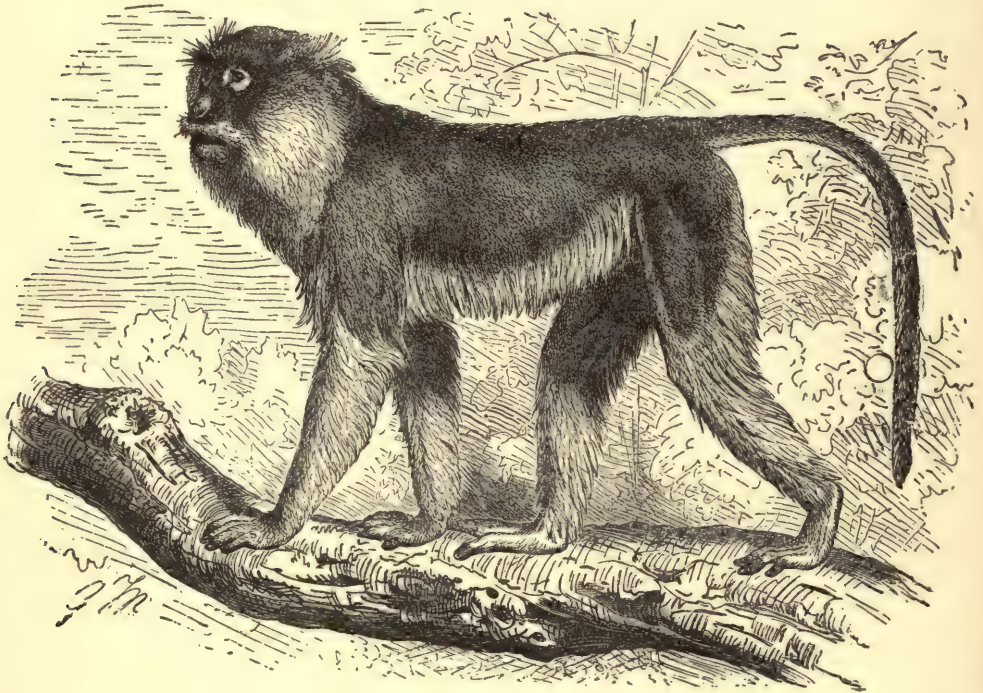
THE MOZAMBIQUE MONKEY (*Cercopithecus rufoviridis*)

The guenons are also represented in the Mozambique and Zambesi districts of the East Coast, although far less abundantly than on the West Coast. The Mozambique monkey agrees with the vervet in having the root of the tail and adjacent regions of a ferruginous red, but differs in the more yellowish-gray tint of the fur of the upper parts, which tends to a blacker hue on the crown of the head, the tail, and the outer sides of the limbs, while the under parts and the inner sides of the limbs are pure white, instead of reddish white.

* Frequently known as *Cercopithecus sabæus*.

THE PATAS MONKEY (*Cercopithecus patas*)*

The West African patas, or red monkey, from Senegambia, differs from all the other members of this group of guenons yet noticed, by the red color of the fur of the greater part of the body; the nose, an arched band on the forehead, and the outer surfaces of the arms being blackish. The reader will, therefore, have no difficulty in recognizing this species whenever he meets with it, and it is well represented in the accompanying figure. In addition to these leading features, we may notice that beneath the large and blackish ears there are thick bushy tufts of light



THE PATAS MONKEY.
(One-eighth natural size.)

gray hair, which extend forward on the cheeks and lower jaw, so as to cause the naked part of the face to be limited to a narrow space between the eyes and the upper lip. From these tufts the grayish-colored hair is continued on the whole of the under surface of the body, as well as on the inner sides of the limbs. The hands are of a dusky brown color, with very short fingers, and the thumb is reduced almost to the condition of a tubercle. The animal is about the same size as the green monkey. The black of the nose continuing upward to the arched band of

*Frequently known as *Cercopithecus ruber*.

the same color above the eyes communicates a very peculiar and characteristic physiognomy to the patas, which led Buffon to describe it as a monkey à *bandeau noir*.

One of the earliest accounts that we possess of the patas is given by an old French traveler, Brue, but it is not to be relied on in all particulars. A living example was first exhibited in the London Zoological Society's menagerie about the year 1834, since which date it has been abundantly represented. This original example, which was very young, was described as being lively and active, but somewhat irascible if disturbed or handled.

THE NISNAS MONKEY (*Cercopithecus pyrrhonotus*)

On the opposite side of Africa, in Nubia and Somaliland, the place of the patas is taken by a closely allied monkey, known as the nisas. So similar, indeed, are these two monkeys that Dr. Gray considered them merely as varieties of the same species; and it is quite probable that if we knew all the monkeys from the intermediate districts of North Central Africa we should find that the one passed into the other. However, as they are considered by the learned secretary of the Zoological Society to be distinct, we must, at least for the present, allow them to stand apart. According to Dr. Gray, the nisas is distinguished from the patas merely by the red color of the body being continued on the shoulders and the outer sides of the arms, instead of those parts assuming a blackish tinge.

The nisas is the species so frequently represented on the ancient Egyptian monuments; and it appears to be undoubtedly the *Cebus* of the ancients, which, on the authority of Pythagoras, was described by Ælian as inhabiting the Red Sea littoral, and was said to be of a bright flame color, with whitish whiskers and under parts.

SYKES'S MONKEY (*Cercopithecus albogularis*)

With the nisas we concluded our notice of the group of guenons in which the head is oval, the muzzle somewhat produced, the whiskers stiff, and the general color greenish or red.

With the East African Sykes's monkey we come to the second and more typical group of these animals which are distinguished by the general form of the head being rounded, the muzzle very short, the whiskers short and rounded and not directed backwards, and the fur generally of a blackish hue, more or less tinged with yellow.

The present species appears to be the East African representative of the mona monkey, to be immediately mentioned, from which it is distinguished by the absence of the white spot on the haunches, and the pure white color of the under parts and chest, which expands on to the throat, and thus suggests the scientific name of the species. It is also of larger size than the mona, being the largest representative of the genus.

This monkey was originally brought to England by Colonel W. H. Sykes, by whom it was described in 1831. The original specimen was purchased at Bombay,

and was said to have come from Madagascar (where, by the way, monkeys are unknown), but it was doubtless imported from Zanzibar.

In describing the original living specimen, Colonel Sykes observes that its manners "are grave and sedate. Its disposition is gentle, but not affectionate; free



THE MONA MONKEY AND DIANA MONKEY.
(One-eighth natural size.)

from that capricious petulance and mischievous irascibility which characterize so many of the African species; but yet resenting irritating treatment, and evincing its resentment by very sharp blows with its anterior hands. It never bit any

person on board ship, but so seriously lacerated three other monkeys, its fellow-passengers, that two of them died of the wounds. It readily ate meat, and would choose to pick a bone, even when plentifully supplied with vegetables and dried fruits."

THE MONA MONKEY (*Cercopithecus mona*)

One of the most familiar of all the guenons is the mona monkey, represented in the upper figure of the illustration on p. 98. This beautiful little monkey may be always easily recognized by the presence of a large and distinct white spot of an oval shape, situated on each hip immediately in front of the root of the tail, the feature being quite peculiar to the species. In size it is rather smaller than the patas.

The mona is a West African monkey, and has no real right to its name, which is merely the Moorish word for monkeys in general. The general hue of the fur of this monkey is described by Dr. Gray as blackish-olive, finely grizzled with yellow; this gradually darkens towards the hinder parts of the body, so that the tail and the outer surfaces of the limbs are nearly black. The under surface of the body is of a nearly pure white, these white parts being separated from the darker regions by an abrupt division; and we have already alluded to the distinctive white spot on each side near the root of the tail. The naked portions of the face are purplish, with the exception of the lips and chin, which are flesh colored. The bushy whiskers, which come forward so as to conceal a large part of the cheeks, are straw colored, with a mixture of a few black hairs. A black transverse band, surmounted by a thin streak of gray, extends from above the eyebrows to the base of the ears; the latter, together with the hands and feet, being of a livid flesh tint.

Writing of this species, which may be described as decidedly more docile and gentle than some of its allies, the French naturalist, Cuvier, observes that "if elegance of shape, gracefulness of movement, gentleness and simplicity of character, united with penetration and intelligence of expression, can inspire affection or make an animal sought after and admired, all these qualities are united in the small group of monkeys allied to the mona, itself distinguished not less by the variety of its colors than by its temper and disposition"—a somewhat flattering description applicable as a rule only to young individuals of both sexes, and to females of all ages, for the adult males are awkward and capricious creatures to manage.

THE DIANA MONKEY (*Cercopithecus diana*)

Before noticing some of the beardless species more nearly allied to the mona, we must mention the well-known West African diana monkey, which derives its name from the distinct white crescent on the forehead above the eyebrows. Its most characteristic feature is, however, the long pointed white beard, so well shown in the lower figure of the illustration on p. 98; while the white streak on the haunches near the root of the tail is also distinctive.

The general color of the fur is black, finely speckled with white, thus producing a grayish grizzle. In addition to the white beard and the crescent on the forehead, the cheeks, the chin, throat, chest, the front of the shoulders, as well as the inside of the thighs and the streak across the haunches, are likewise white. On the other hand, there is a broad streak down the back of a bay color, and the same tint also prevails on the rump. The face, tail, and the outer sides of the wrists and legs are black, as well as the hands and feet.

All the colors of this animal are sharply defined from one another; and the long, narrow, black face, terminating below in the long and pointed beard, and surmounted by the crescent above the eyebrows, give it a peculiar and characteristic expression. The whole length of the head and body is about 18 inches, while the length of the tail reaches to some 24 inches.

The real name of the diana monkey in its native districts is said to be Roloway on the Gold Coast, although Exquima is given as its title on the Congo. In disposition it is one of the most gentle and easily tamable of the guenons; but, like the greater number of its tribe, its temper is milder in youth than in mature age. When young it appreciates caresses, and it nods and grins when pleased; but these expressions of feeling are generally abandoned at a later period.

THE BEARDED MONKEY (*Cercopithecus pogonias*), CAMPBELL'S MONKEY (*C. campbelli*), THE RED-BELLIED MONKEY (*C. erythrogaster*), AND WOLF'S MONKEY (*C. wolfi*)

We may notice under this collective heading four species of monkeys closely allied to the mona, but distinguished both from that species and the diana by the absence of any spot or streak of white on the haunches. While the first three species are West African, the fourth, which has only recently been described from a specimen living in the Zoological Gardens at Dresden, is from West Central Africa.

The bearded monkey, also known as Erxleben's monkey, has the fur of the upper parts either grayish or olive brown, finely grizzled with gray or yellow. From above the eyes to the ears there is a black streak, while there is also a stripe down the back of the same hue; and the hands and feet, as well as the tail, are likewise black. The forehead, the whiskers, the small moustache, and the under parts of the body and the inner sides of the limbs are yellowish. This species has been obtained from Fernando Po and the Gabun.

Campbell's monkey, which inhabits Fernando Po and Sierra Leone, may be distinguished by the absence of the black streak running from above the eyes to the ears, and also by the whitish color of the under parts and inner sides of the limbs. The general color is blackish olive, washed with yellow.

The red-brown color of the chest and under parts, from which it takes its name, is amply sufficient to distinguish the red-bellied monkey; but as additional characteristics, we may mention that the outsides of the thighs and legs are grayish black, while the front of the thighs and the under surface of the tail are grayish white.

Finally, Wolf's monkey, which has light under parts, differs from the other species in the ferruginous color of the legs, as well as by the light patches on the inner sides of the arms and thighs. This species is interesting as being the only representative of the mona group (if we exclude the larger Syke's monkey) which is found eastward of Western Africa.

THE BLACK-BELLIED MONKEY (*Cercopithecus pluto*)

The black-bellied or pluto monkey, from Angola, is another West African species, readily distinguishable by the dark color of the under parts of the body and the inner sides of the limbs, which are typically of a reddish-black.

Like the species of the mona group, there is no beard, but large bushy whiskers, well shown in the accompanying figure.

The general color of the fur is black, finely grizzled with gray; the forehead has a white band, and the sides of the forehead, as well as the shoulders, chest, tail, and limbs, are entirely black, and there is no white on the haunches in the typical form.

Dr. Anderson identifies, however, with this species the so-called diadem monkey (*C. leucocampyx*), which also has black under parts, but is distinguished by a white streak across the haunches.



THE BLACK-BELLIED MONKEY.
(From Gray, *Proc. Zool. Soc.*)

THE MOUSTACHE MONKEY (*Cercopithecus cephus*)

In all the round-headed and short-muzzled guenons yet mentioned the nose and body are of the same color. There is, however, another division of the guenons, in which the color of the nose differs from that of the body. Out of the seven species of this subgroup recorded by Dr. Gray we shall select for notice the four which have been represented of late years in the Gardens of the London Zoological Society, premising that the whole seven are West African.

The leading characteristics of the moustache monkey are to be found in the presence of a triangular blue mark on the nose and in the yellow whiskers. Its general color is olive-green, speckled with yellow; the throat and under parts being gray, the face and temples black, and the feet and hands blackish.

THE HOCHUR MONKEY (*Cercopithecus nictitans*)

The hochur monkey is one of several species belonging to this subgroup of guenons, collectively known as white-nosed monkeys, from the circumstance that the nose in all of them is covered with white hairs. This particular species is distinguished by the blackness of the fur on both the upper and lower surfaces of the body, that of the back being finely speckled with yellow. The naked part of the face is of a bluish-black color; the upper eyelids are flesh colored, and the hands and feet jet black.

This species, sometimes known as the larger white-nosed monkey, may be readily distinguished from the next, not only by its superior size, but also by its more prominent nose. It has been described as lively and good natured, but not so gentle and familiar as the next species, and more resembling in its temper and general character the mona monkey. It has been obtained both from Fernando Po and Guinea.

THE LESSER WHITE-NOSED MONKEY (*Cercopithecus petaurista*)

This elegant monkey, which comes from Guinea and Sierra Leone, is one of the smallest of the guenons. It was described in the works of the French naturalist Buffon under the well-chosen name of *Blanc-nez*; and is readily distinguished, as we have said, from the hochur by its smaller size and the flatness of its nose, as well as by the lighter tint of the under parts. In color the fur of the back is olive-green, speckled with yellow; the face black; the white spot on the nose small and nearly triangular; and the cheeks, chin, under parts of the body, the inner sides of the limbs, and the under side of the tail, white.

The following account of the habits of this species in confinement is taken from an anonymous writer, who states that the manners of this monkey "are playful and engaging beyond any other species we have ever observed, and it has an amiability and innocence in its conduct and expression which, united to its lively and familiar disposition, never fail to make it a prime favorite with its visitors. An individual of this species, which formerly lived in the Garden of the Zoological Society, was confined in the same cage with a young hanuman, whose gravity was sorely disturbed by the unwearied activity and playfulness of its mercurial companion. Whilst the white-nose was frolicking round the cage or playing with the spectators, the hanuman would sit upon the perch, the very picture of melancholy and apathy, with his long tail hanging down to the bottom; but his attention was roused and his security endangered every moment by the tricks of the restless little creature, which in its sports and gambols continually caught the hanuman's tail, either to swing itself out of the reach of the spectators, or, like a boy at his gymnastic exercises, to assist it in climbing up to the perch. All this, however, was done with great good nature on both sides, and it was highly diverting to see the playful innocence of the one, and the gravity with which the other regarded it, like a fond parent enjoying the innocent follies of a favorite child."

THE LUDIO MONKEY (*Cercopithecus ludio*)

The last of the guenons that we shall notice is the ludio monkey, which is another of the white-nosed group. Its fur is black, profusely grizzled with gray, the chin, chest, and the inner sides of the upper arms being white; while the temples, nape of the neck, shoulders, and the greater portions of the limbs, as well as the end of the tail, are pure black. The white spot on the nose has an oblong shape, and is higher than broad.

The species is said to range into Central Africa. The red-eared monkey (*C. erythrotis*), which is likewise West African, differs from the other members of the group in having red hairs on the nose and ears.

THE MANGABEYS, OR WHITE-EYELID MONKEYS

Genus *Cercocebus*

The mangabeys, or, as they are often called, white-eyelid monkeys, comprise a small group of four West African species, which, while agreeing in all external characteristics with the guenons, are distinguished by the presence of a projecting heel at the hinder end of the last molar tooth on each side of the lower jaw, so that the crown of this tooth carries five, in place of four tubercles. In this respect the mangabeys agree with the great group of macaques, which follow next in the series; and on this ground these monkeys have been separated from the guenons to form a distinct genus under the name of *Cercocebus*. There has been much discussion as to the advisability of thus separating the mangabeys, but it has at least the advantage of somewhat restricting the unwieldy group of the guenons.

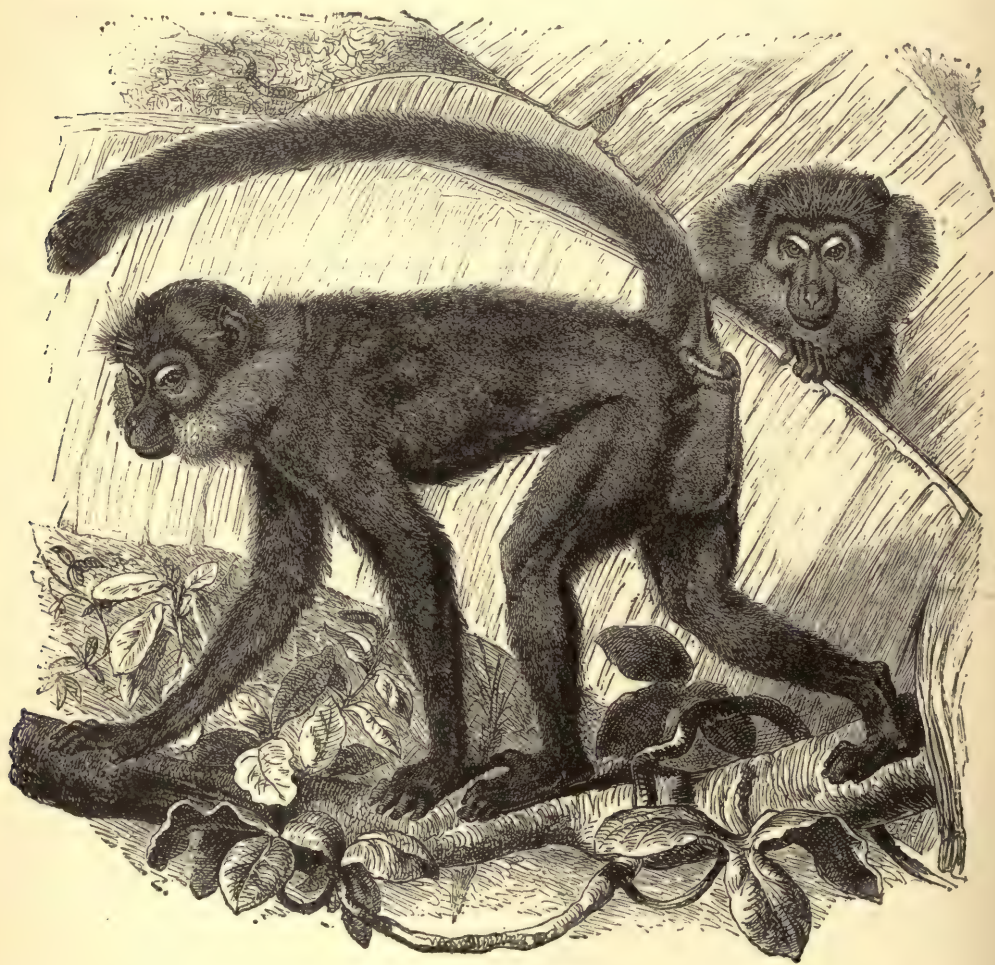
The name Mangabey, it may be observed, is taken from the district Mangabe, or Manongabe, in Madagascar, and was applied by the French naturalist Buffon to these monkeys, from the mistaken idea that they came from that island, which in his time appears to have been a kind of refuge for the destitute, in regard to animals whose habitat was unknown. In spite, however, of this totally erroneous origin the name is a convenient one, and has been subsequently almost universally adopted for this group of monkeys.

All the mangabeys have an oval-shaped head, with a somewhat long muzzle; and they may be readily recognized in the living condition by their white eyelids. Moreover, their hairs differ from those of the guenons in not being ringed with different colors.

THE SOOTY MANGABEY (*Cercocebus fuliginosus*)

We select as our first example of these monkeys the sooty mangabey, represented in the illustration on p. 104. This monkey belongs to a group containing three out of the four species, and characterized by the hair of the crown of the

head being directed backwards, without any prolongation into a crest. As its name implies, the fur of the sooty mangabey is of a deep and dull black hue, the chin and under parts being ashy. The face is livid, marked with dark brown blotches about the eyes, nose, muzzle, and cheeks; the ears, as well as the palms of the hands and the soles of the feet, being of a blacker brown.



THE SOOTY MANGABEY.
(One-sixth natural size.)

At least, in captivity, this species is said to be characterized by the unusual habit of keeping its long tail turned forward over the body. In confinement this mangabey is docile and good tempered, and more amenable to instruction than is the case with the majority of the larger guenons. A specimen, which lived more than fifty years ago in the Zoological Society's Gardens, was said to be a most importunate beggar: "But instead of snatching the contributions of his visitors with violence or anger, like the generality of monkeys, he solicited them by

tumbling, dancing, and a hundred other amusing tricks. He was very fond of being caressed, and would examine the hands of his friends with great gentleness and gravity, trying to pick out the little hairs, and all the while expressing his satisfaction by smacking his lips, and uttering a low surprised grunt."

The white-collared mangabey (*C. collaris*) may be easily distinguished from the sooty mangabey by its blackish-gray color, the white round the neck, and the bay on the crown of the head; the white of the collar extending to the cheeks throat, and chest.

The third representative of this group is the white-crowned mangabey, which takes its name from a characteristic white spot on the crown, and is also distinguished by a white streak running down the middle of the back.

THE GRAY-CHEEKED MANGABEY (*Cercocebus albigena*)

The circumstance that the hair of the crown of the head is lengthened so as to form a distinct crest affords a ready means of distinguishing the gray-cheeked mangabey from its three congeners. The general color of this monkey is blackish, but its name comes from the grayish hairs on the sides of the throat and cheeks. It was first made known to science in 1850 by the late Dr. Gray, from specimens sent home from the West Coast of Africa by Du Chaillu, previously to his great expedition of 1855.

THE MACAQUES

Genus *Macacus*

After having devoted so much space to the monkeys of Africa, we turn to those Asiatic species known as Macaques, of which a group is represented in our colored plate.

We have already seen the curious origin of the term mangabey, applied to the group of African monkeys last mentioned, and it appears, from what we have to say immediately, that there is a kind of fatality in regard to the misapplication of names among monkeys. So far as can be learned, the name *Macac* or *Macaque* seems to be a barbarous word which, in Margrave's *Natural History of Brazil*, published in the year 1648, is given as the native name of a monkey from the Congo and Guinea. Buffon, however, with a facility for misappropriation for which he was rather celebrated, transferred this name to the Indian group, forming this part of our subject, and to them it has ever afterwards clung, having been Latinized into *Macacus*. In spite of its origin, the name is good enough, and so must remain.

Under the heading of the mangabeys we have seen how these monkeys differ from their cousins the guenons in having a heel, and thus five cusps, to their last lower molar teeth, and also in the uniform coloration of their individual hairs. As this is also the case in the macaques, it is obvious that in this respect the

mangabeys form a transition to them from the guenons, and we may now consider how the macaques and mangabeys are to be distinguished from one another.

Characteristics In the first place, macaques are always of stouter build than the mangabeys; and they are further distinguished by the considerably greater prolongation of the muzzle, and the larger size of the naked callosities on

the buttocks. Some of the macaques have their tails as long as those of the guenons and mangabeys; in others these appendages are very short, while in a few they are actually wanting, thus showing that the presence or absence of a tail is of no import either as a generic characteristic or as indicative of a higher or lower degree of organization. In common with all the monkeys we have hitherto considered, the nostrils of the macaques do not reach as far forward as the extremity of the muzzle.

From these characteristics it will be apparent that while the macaques are sufficiently distinguished from the mangabeys to be entitled to rank as a separate genus, yet both groups are closely allied. And,



THE BURMESE PIG-TAILED MONKEY.

(From Sclater, *Proc. Zool. Soc.*, 1860.)

as we shall see that as in the opposite direction the macaques are intimately connected through one singular intermediate form with the baboons of Africa, we have evidence that an almost complete transition exists from the guenons through the mangabeys to the macaques, and thus to the baboons.

In speaking of the macaques as Asiatic monkeys, we must guard ourselves by mentioning that one solitary outlying species is found in the mountains of North-west Africa, and also on the opposite coast of Gibraltar. The greater majority of the species are, however, confined to India, Burma, the Malay Peninsula, and the islands of Borneo, Sumatra, etc. Some range as far east as China, while one is found

even in Japan. To the northward, macaques extend into the outer ranges of the Himalayas, while a single species inhabits the secluded highlands of Eastern Tibet.

Habits The whole of the large number of monkeys reckoned as macaques seem to have much the same general habits, being always found gathered together in troops, which may be of considerable numbers, and always comprise individuals of both sexes, and of all sizes and ages. They are forest-dwelling animals; and, while active and rapid in their movements, are less markedly so than their compatriots the langurs. As regards food, macaques have a varied appetite, most, if not all, of them eagerly eating insects as well as seeds and fruits. Moreover, they have occasionally been observed to devour lizards, and it is reported that frogs also form part of their food on rare occasions, while one species is known to subsist partly on crustaceans. Their cheek pouches are of very large size, and it is the general habit of these monkeys to stuff these receptacles as full as they will hold on every available occasion.

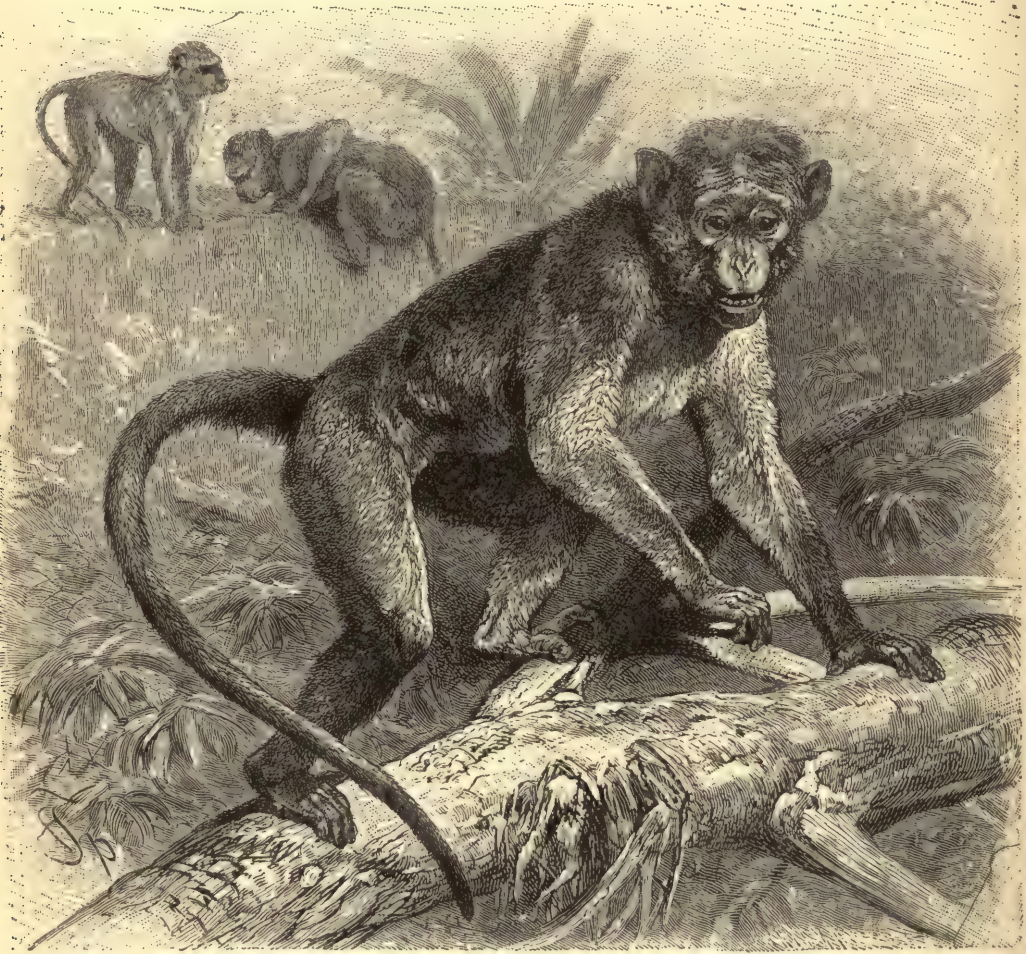
According to Mr. Blanford, from whose works the above account of their habits is paraphrased, the voice and gestures of all the macaques are similar, and differ markedly from those of the langurs. In regard to these points, the same writer gives an interesting quotation from the manuscript notes of Colonel Tickell—an excellent observer of the habits of Indian animals—which we repeat. Colonel Tickell says: "Anger is generally silent, or, at most, expressed by a low hoarse '*heu*,' not so gular or guttural as a growl. Ennui and a desire for company by a whining '*hom*.' Invitation, deprecation, entreaty, by a smacking of the lips and a display of the incisors into a regular broad grin, accompanied with a subdued grunting chuckle, highly expressive, but not to be rendered on paper. Fear and alarm by a loud harsh shriek, '*kra*' or '*kraouk*,' which serves also as a warning to the others who may be heedless of danger. Unlike the langurs and gibbons, they have no voice if calling to one another."

In confinement most of the species are docile if caught young; but old males that have been captured when full grown are sometimes exceedingly spiteful; and the present writer has a vivid recollection of a pig-tailed macaque formerly in the Zoological Gardens at Calcutta that was very ferocious, and would fly at every visitor who approached his cage with open mouth and the most menacing gestures. In their wild state it also appears that these monkeys will occasionally show fight. Thus Mr. Sterndale tells us that on one occasion during the Indian Mutiny he came across a party of rhesus macaques, among whom were several females with young ones. He endeavored without success, to run them down, in order to capture the latter, when he was deliberately charged by the old males of the party, the leader of whom he had to dispatch with a pistol bullet. Several of the species will breed in captivity. As a rule, their manners when in the latter state are the reverse of pleasant.

Since the number of species of macaques is very large, we shall select for especial notice only some of the better-known types, commencing with those with the tails so long that their length exceeds three-quarters of the combined length of the head and body, and concluding with those in which the length of this appendage is less than three-quarters of that of the head and body.

THE BONNET MONKEY (*Macacus sinicus*)

One of the best and longest known of the longer-tailed macaques is the South Indian bonnet monkey, which is one of the two closely allied species characterized by the circumstance that the hair of the crown of the head is lengthened, and arranged in a radiating manner from the middle line. A representation of this monkey is given in the accompanying figure, and in Fig. 3 of the colored plate.



THE BONNET MONKEY.

This species takes its name from the crest of hair on the crown, which, instead of coming over the forehead, as a rule stops short of that part of the head, and thus assumes a toque-like form. On the forehead the short hair is usually parted down the middle line. The fur, which is of moderate length, and generally straight and smooth, is brown or grayish-brown above, and pale brown, or whitish on the under

parts. The face and ears are flesh colored, and in some examples the ends of the hairs are ringed. The tail is generally nearly or quite as long as the head and body, the length of the two latter being about twenty inches.

This macaque, which occurs all over Southern India and extends westward to Bombay, is the common monkey of those regions, being found not only in the forests, but likewise in the towns, where it pillages the shops of the *bhantias*, or native grain-sellers. It is exceedingly mischievous, and a ready mimic, although Mr. Blanford believes that the rhesus monkey is its equal in these respects.

In Ceylon this monkey is replaced by the closely allied toque monkey (*M. pileatus*), which appears only to differ in color, although the long hair of the crest of the head seems to be more generally continued on to the forehead. It is shown in Fig. 5 of the colored plate.

Among the Singalese this monkey is known as the Rilawa. Sir Emerson Tennent speaks of it as being "the universal pet and favorite of both natives and Europeans. The Tamil conjurers teach it to dance, and in their wanderings carry it from village to village, clad in grotesque dress, to exhibit its lively performances." After all, however, the mimicry and amusing tricks of a monkey in captivity are a mere shadow of what they are in its native condition, so that persons who have only seen these animals in confinement have but a faint idea of their true nature.

THE CRAB-EATING MACAQUE (*Macacus cynomolgus*)

This species derives its name from its peculiar habit of feeding largely on crabs from the brackish water of the lagoons and swamps on the coast. It is the true macaque of Buffon, and is known to the Malays, apparently from its cry, as the Kra. This monkey is shown in Fig. 6 of the colored plate.

It may be at once distinguished from the bonnet monkey by the circumstance that the hair on the crown of the head is neither longer than the rest nor distinctly radiated from the middle. In some individuals there is, however, a trace of a crest, with slight radiation of the hair from one or more points on the forehead. As a rule, the general color of the fur of the upper parts varies from a dusky or grayish-brown to a rufous or golden-brown; the under parts being either light grayish-brown or nearly white. The hairs of adult individuals vary in color in different parts of their length, and are ringed at their tips. The naked parts of the face and the callosities on the buttocks are flesh colored or dusky. The eyelids are either white or bluish-white. The tail is nearly as long as the head and body, the combined length of the two latter reaching to 22 inches.

In the dark and smaller variety of this common monkey the fur is dusky; while in the lighter or golden-rufous variety, its hair is flesh colored.

The range of the crab-eating macaque is a very wide one, extending from Siam in the east through the Malay Peninsula into Lower Burma and the Arakan coast. It is also found in the Nicobar Islands in the Bay of Bengal, although Mr. Blanford considers that it has probably been introduced there by human agency.

What induced the ancestors of this monkey to forsake the usual simian food and take to a diet of crabs and insects it is difficult to conceive; unless, indeed, they

may have been driven to it during a season of scarcity, and found it so much to their liking that they have continued it ever since. Be this as it may, there is no doubt whatever as to the crustacean-devouring proclivities of this species. For instance, Sir Arthur Phayre mentions that "these monkeys frequent the banks of salt-water creeks and devour shell fish. In the cheek pouches of a female were found the claws and body of a crab. There is not much on record concerning the habits of this monkey in its wild state beyond what is stated concerning its partiality for crabs, which can also, I believe, be said of the rhesus in the Bengal sanderbans." According to Colonel Tickell, as quoted by Mr. Blanford, the crab-eating macaque is common on the tidal creeks and rivers of Burma and Tenasserim,



THE LION-TAILED MONKEY

(One-tenth natural size.)

especially in the delta of the Irawadi. They go usually in small family parties of from five to fifteen individuals, including an old male and four or five females with their offspring. Their home is among the roots and boughs of the mangrove trees, and they spend a large portion of their time in searching for insects and crabs. From the constant presence of human beings on the waterways near which they dwell, these monkeys become very tame and can be easily approached. They will even, Mr. Blanford tells us, pick up rice or fruit thrown down to them. Still more remarkable is the facility with which they can swim and dive. Colonel Tickell states that on one occasion a male of this species that had been wounded and placed for security in a boat, jumped overboard and dived several times over to a distance of some fifty yards, in order to prevent recapture. Like most macaques, this



MACAQUES.

species is gentle if captured at a sufficiently early age, but the old males always become fierce and morose. On account of the white eyelids of this monkey care must be taken not to confound it with the mangabeys noticed above.

THE LION-TAILED MONKEY (*Macacus silenus*)

With the peculiar-looking lion-tailed monkey of Western India, well represented in the illustration on p. 110, and also in Fig. 2 of the colored plate, we come to the first of the macaques in which the length of the tail is less than three-quarters of that of the head and body taken together.

The lion-tailed monkey, often incorrectly called the wanderu (a term which as we have seen, should be restricted to the langurs of Ceylon), may be distinguished from all the other species by its general black color, and the enormous gray beard and ruff, which surrounds the black face, with the exception of the middle of the forehead, where it stops short. The fur is long, and the slender tail is tufted at its extremity, and measuring from half to three-quarters the united length of the head and body. The thin and tufted tail, like that of a lion, is one of the characteristic features of this species, and that from which it derives its name. The enormous ruff, totally concealing the ears, is, however, that which especially attracts attention, and gives the owner somewhat the appearance of a black-faced old man with shaggy whiskers and beard.

These monkeys inhabit the Malabar, or Western Coast of India, from Cape Comorin to about the fourteenth parallel of latitude, being especially abundant in the districts of Travancore and Cochin. They restrict themselves to the forest lands on the range of trappean mountains known as the Western Ghats, and are always found at a considerable elevation above the level of the sea. Dr. Jerdon says that they associate in troops of from twelve to twenty or more in number. They are excessively shy and wary, and when caught are sulky and savage in captivity, so that it is only with great difficulty that they can be taught to perform any feats of agility or mimicry.

THE BENGAL MONKEY (*Macacus rhesus*)

Perhaps the best known of all the macaques is the common Bengal or rhesus monkey, the bandar of the Hindus, which is found all over Northern India. It is shown in Fig. 1 of the colored plate.

This monkey presents but little resemblance to the last species, having no trace of a beard or a ruff, and its color being brown, with a tinge of gray. As a species it is characterized by the straightness of its moderately long hair, and also by the buttocks being naked for some distance round the callosities. The tail is about one-half the length of the head and body, and tapers regularly from base to tip, without any trace of a terminal tuft. The face, as well as the callosities on the buttocks, are flesh colored, except in the adults, when they are bright red.

In India the Bengal monkey is found continuously northward from the valley of the Godaveri to the Himalayas, extending to the west coast at Bombay. It

inhabits the valley of Kashmir and surrounding regions, at elevations of and above four thousand feet. In the neighborhood of the hill sanitarium of Simla these monkeys are found at an elevation of between eight and nine thousand feet above the sea level; and it is one of the regular expeditions from Simla to ride or walk to see the monkeys on their own hill, which rejoices in the appropriate name of Jako. Here they are regularly fed by a fakir, who has taken up his abode on the same mountain, and they come down in troops at his well-known call. Indeed, these monkeys are almost invariably found in large droves; usually in the forests or more cultivated lands, but occasionally near and in the towns. Although not regarded as sacred, it appears that the rhesus monkey is frequently protected by the Hindus, and in Kashmir the writer has seen them forming part and parcel of the appanages

of the temples. In several parts of India the Hindus have, indeed, a strong objection to the slaughter of these monkeys.

The rhesus is an intelligent creature, and, if captured young, is docile and easily taught. It is the common monkey carried about by itinerant jugglers in Northern India, by whom it is taught many amusing tricks. Old animals, more especially males, become vicious and spiteful.

In their wild state these monkeys make a hideous noise with their incessant chattering, and they are always mischievous. In addition to the consumption of large quantities of fruit and seeds, they also subsist on insects and spiders, and parties of



THE BENGAL MONKEY.

them may frequently be seen carefully searching the ground for these delicacies. Mr. Blanford tells us that the rhesus, like the crab-eating macaque, swims well, and takes readily to the water.

Professor Ball relates a curious anecdote of these monkeys: "When at Malwa Tal [near the Himalayan Station of Naini Tal], which is one of the lakes where I spent a day, I was warned that, in passing under a landslip which slopes down to the lake, I should be liable to have stones thrown at me by monkeys. Regarding this as being possibly a traveler's tale, I made a particular point of going to the

spot in order to see what could have given rise to it. As I approached the base of the landslide on the north side of the lake, I saw a number of brown monkeys (*M. rhesus*) rush to the sides and across the top of the slip, and presently pieces of loosened stone and shale came tumbling down near where I stood. I fully satisfied myself that this was not merely accidental; for I distinctly saw one monkey industriously with both fore-paws, and with obvious *malice prepense*, pushing the loose shingle off a shoulder of rock. I then tried the effect of throwing stones at them, and this made them quite angry, and the number of fragments which they then set rolling was speedily doubled. This, though it does not actually amount to throwing or projecting an object by monkeys as a means of offense, comes very near to the same thing, and makes me think that there may be truth in the stories of their throwing fruit at people from trees."

It is probable that the Bengal monkey ranges to the northeast into Assam and Upper Burma, and thence into the province of Yunnan, in Western China. In Szechuen, and eastwards into the interior, it is replaced by the closely allied Chinese rhesus (*M. lasiotis*).

Another nearly related species is the Himalayan macaque (*M. assamensis*), found at considerable elevations in the Eastern Himalayas, Assam, the Mishmi Hills, and parts of Upper Burma. According to Mr. Blanford it is distinguished from the Bengal monkey by the wavy nature of the hair, which in the Himalayan specimens assumes a decidedly woolly texture. Dr. Anderson tells us that it is larger than the last-named species, and more powerfully and compactly built, and thus approaches the under-mentioned pig-tailed monkey. Mr. Blanford further observes that, whether wild or tame, it is more sluggish in its movements than the Bengal monkey; and also that there is a slight difference between the voices of the two species

THE PIG-TAILED MONKEY (*Macacus nemestrinus*)

The next species of macaque we select for notice is the one represented in the figure on the following page, and commonly known as the pig-tailed monkey. It is distinguished from those we have already mentioned by the shorter tail, which is thin and whip-like, and only about one-third the length of the head and body.

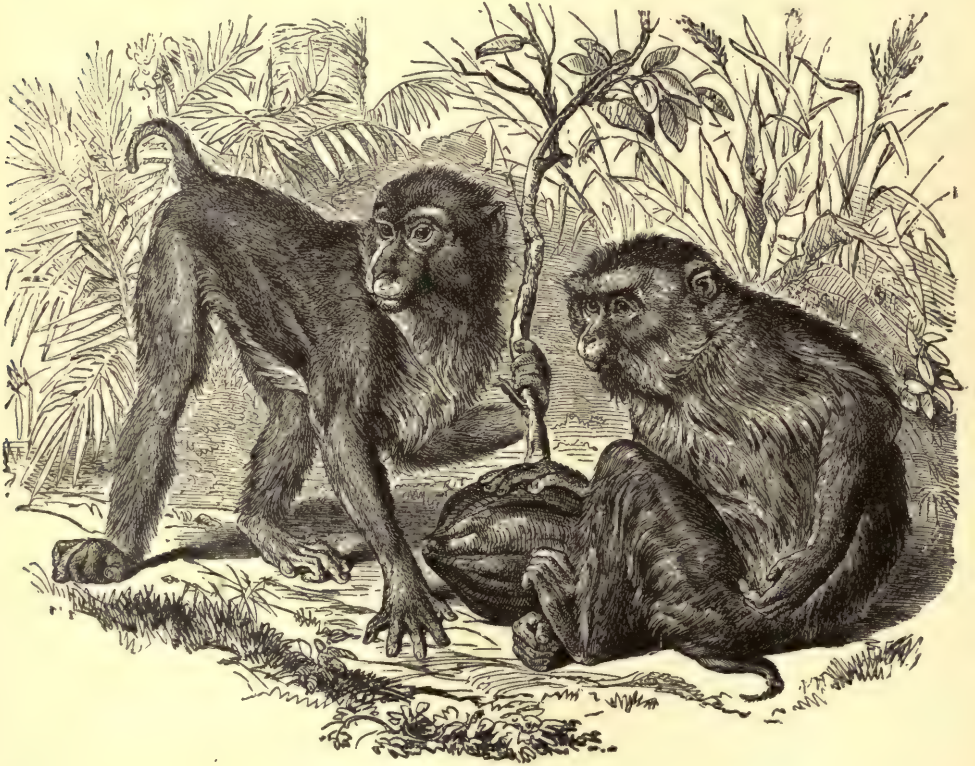
It is a comparatively stout and long-limbed monkey, easily recognized by the hair radiating from the centre of the head, the slender pig-like tail, and the very projecting muzzle, which approximates to that of the baboons. Dr. Anderson compares an adult full-grown male to a good-sized mastiff, both as regards size and strength. This monkey has been long known to science, and was described by Buffon as the maimon. It inhabits the province of Tenasserim, and thence extends southward into the Malay Peninsula, and is also found in the islands of Borneo and Sumatra.

The voice and manners of this monkey are described as being very similar to those of the Bengal monkey. Its habits were long ago described by Sir Stamford Raffles from specimens observed by him in Sumatra; and this writer relates that the inhabitants of that island train these monkeys to ascend the cocoa palms, and select

and then throw down the ripest fruit. It seems probable that it must be only young or female individuals that are thus taught to serve their masters, since the old males are exceedingly fierce and vicious, and from their size and powerful build are formidable antagonists.

THE BURMESE PIG-TAILED MONKEY (*Macacus leoninus*)

In Arakan and Upper Burma the place of the pig-tailed monkey is taken by the nearly allied species, known as the Burmese pig-tailed monkey, represented in the illustration on p. 106.



THE PIG-TAILED MONKEY.
(One-ninth natural size.)

The animal may be easily distinguished from its relations by its shorter limbs, shorter muzzle and longer hair, as well as by the black horseshoe-like crest on the temples above the eyes, which stands out in marked contrast to the general brown color of the rest of the fur. Moreover, the short tail, which is generally carried over the back, is more hairy, and more or less distinctly tufted at the end. The males are dark brown above, but the females somewhat lighter; the face in both sexes being of a dusky flesh color, while the combined length of the head and body

is about 23 inches; the tail only measures some 8 inches, exclusive of the hair at its extremity, which adds another 2 inches to its length.

The late Mr. E. Blyth, who speaks of this species as the long-haired pig-tailed monkey, in contradistinction to the short-haired pig-tailed monkey (*M. nemestrinus*), says that it does not appear to be at all common, and that it chiefly inhabits the range of limestone mountains from the north of Arakan to an undetermined distance southward. The Burmese pig-tailed monkey serves to connect the other species with the Bengal monkey.

THE BROWN STUMP-TAILED MONKEY (*Macacus arctoides*)

The brown stump-tailed monkey may be taken as an example of another group of macaques inhabiting Burma and the Malayan region, and thence ranging into China, Tibet, and Japan, and characterized by the reduction of their tails to a mere rudimentary stump.

The present species is characterized by the length of its dark brown or blackish-brown hair, which may measure more than four inches, and also by the bright red hue of the naked portions of the face and buttocks. As in the last-named species, the terminal portions of the hairs of old individuals are decorated with rings of different colors. The length of the head and body is probably about 24 inches, while that of the tail does not exceed 1 or 2 inches.

This monkey appears to range from the southern parts of Assam into Upper Burma, and is also found in Cochin-China. We have not, however, full information on the subject of its geographical range, and absolutely none as to its habits, although it is said to be an inhabitant of hilly districts.

It has its tail sparsely clad with hair, or naked in old individuals. In the coldest and least accessible forests of Eastern Tibet, the stump-tailed macaques are represented by a species (*M. tibetanus*) characterized by its larger size, and the thickly-haired tail. We have already seen how the same elevated regions are inhabited by a langur; and if Europeans ever obtain free access to Tibet, it will be an interesting subject of investigation to discover on what these monkeys subsist during the long and cold winters of that country.

The Moor macaque (*M. maurus*), which has received several distinct names—*M. ochreatus*, for instance—represents the stump-tailed monkeys in Borneo, Celebes, and probably some of the other Malayan islands, and is a dark and black-faced species.

In Japan the group is represented by the Japanese macaque (*M. fuscatus*), which is one of those in which the tail is thickly haired. We have, however, still much to learn as to the number of species of these stump-tailed macaques, and their exact geographical distribution, while information as to their mode of life is desirable.

THE MAGOT, OR BARBARY MACAQUE (*Macacus innuus*)

In the preceding sections we have seen how a gradual shortening of the tail can be traced as we pass from the bonnet macaque, through the Bengal monkey and its

allies, to the pig-tailed, and thence to the stump-tailed group. From the latter it is but a step to the total loss of the tail; and the magot, or Barbary macaque (the Barbary ape of many authors), presents us with the culminating member of the series. This total absence of a tail was long regarded as a reason for separating the magot as a distinct genus from the other macaques; but it is quite clear that there is no sort of justification for this view. The species is represented in Fig. 4 of the colored plate, as well as in the illustration following.



THE MAGOT.
(One-sixth natural size.)

In addition to being the only tailless macaque, the magot is the sole existing species of the group which is not Asiatic. The magot inhabits, indeed, the north-west corner of Africa, in the districts of Morocco and Algeria, being especially common in the latter country in the neighborhood of the city of Constantine. It is also found across the Straits in Gibraltar, and some of the neighboring parts of Spain, but whether indigenous there, or introduced from the opposite

continent by human agency, does not appear to be clearly made out. The wide separation of this macaque from its Asiatic congeners suggests that it is the direct descendant from those extinct species which are found in the later geological deposits of various parts of Europe, at a date when we know that the genus was already in existence in India.

That the magot is the *Pithecus* of the ancients there is not a doubt, as the description given by Aristotle is enough to identify it. This species was indeed, in all probability, the only tailless member of the order with which the ancients were acquainted. It was, moreover, the animal from which the ancient Greeks obtained such knowledge as they possessed of human anatomy; and an account of its anatomy, given by Galen, has been handed down to our own times. The name Magot is of French origin, and was applied by Buffon.

This monkey is as large as a good-sized dog; and the upper parts of its body, and the outer sides of the limbs, are of a light yellowish brown, becoming somewhat deeper on the head, and also along a line bordering the cheeks. The under parts are of a dull yellowish white, while the naked portions of the face, hands, and feet, as well as the callosities on the buttocks, are flesh colored. The rudiment of the tail consists merely of a little fold of skin, having no sort of connection with the end of the backbone.

One of the best early original accounts of the magot is given by the French naturalist René-Luiche Desfontaines, who resided for some time in Algeria, during the closing decades of the last century. This writer observes that the magots "live in troops in the forests of the Atlas Mountains nearest to the seashore, and are so common at Stora that the surrounding trees are sometimes covered with them. They live upon the cones of the pine, sweet chestnuts, and the figs, melons, pistachio nuts, and vegetables which they steal from the gardens of the Arabs, in spite of all the pains taken to exclude these mischievous animals. Whilst in the act of committing these thefts, two or three detach themselves from the general body, and keep watch from the tops of the surrounding trees or rocks; and as soon as these sentinels perceive the approach of danger, they give warning to their companions, who presently scamper off with whatever they have been able to lay their hands on."

A military officer, formerly stationed at Gibraltar, writing in 1880, has given the following excellent account in the *Field* newspaper of the "Apes of the Rock" magots at that place. After stating that Gibraltar is the only European locality where monkeys occur, the author observes, that young magots "may frequently be seen in summer in the Moors' part of the market place, brought over from Barbary; and, doubtless, the ancestors of the existing colony were similarly imported. The census frequently taken by the sergeant in charge of the signaling department gives their present number as twenty-five. . . . These apes were formerly very numerous on the rock, and there were several gangs of them, but they were so predaceous in their habits, coming down to the gardens in the upper part of the town, and stealing fruit, especially figs, that they were killed by trap or poison, so as nearly to bring about their extinction. In November 1856, a garrison order was published for the guidance of the signal-master," which for-

bade the destruction of the monkeys, and gave directions as to their being counted at regular intervals. "From that time," continues our author, "the register has been very regularly kept by the signal-master. There were only four or five at this time, and but three in 1863, when General Sir W. Codrington, who was then governor, saved them from destruction by a fresh importation from Africa. The following note occurs in the Journal of the 26th of May 1863, 'Turned out four apes, wild from Barbary, two males and two females, all young.' After some time the newcomers made friends with the apes of the old stock; and the band increased, but very slowly, however, owing to the great preponderance of females, until the present time, and it may be expected, as the signal-master observes, now that there are two adult and rival males, that it will divide. Those who wish to see them will do well to remember that their haunts on the rock are determined by the direction of the wind. They prefer the ledges of the [to man] inaccessible abrupt escarpment of the Mediterranean face; but cannot stand the cold damp Levanter wind which, as its name indicates, blows from the eastward, and compels them to resort to the western slopes on the town side of the rock. At the bottom of Charles V.'s wall, overhanging the Alameda Gardens, is a favorite spot. On the western side, the Monkeys' Alameda, a small bushy plateau half-way down the precipice, is another choice resort, as is also Monkeys' Cave, close to the sea. Of late years they have become sufficiently confident in their friend and protector, the signal-master, frequently to enter the enclosure of the station, especially in the summer drought, when they come for water. In a letter to me, of the 3rd of May, Sergeant Brown [the signal-master] says: 'The monkeys are sitting on the wall of the station as I write this—the first time this season that they have come up for water.'

"Their food consists of grass (the young blades of which I have seen them eating with avidity), and of a variety of roots and bulbs; those of the yellow Cape oxalis being much sought after. The fruits of the palmetto—*monkey-dates*, as the Gibraltar urchins, who also much appreciate the little brown viscous clusters, call them—are greedily devoured when ripe. The signal-master has never observed them take any food left in their way at the station but a few grapes, of which they seemed very fond.

"In Sergeant Brown's letters I find several notes concerning these interesting animals, which may be here introduced. 'In the spring of 1872, two were shot by a young officer, who had been but a short time in the garrison, and probably did not know that the monkeys were so strictly preserved. He replaced them with either two or three of the same kind from Barbary, but the rock monkeys killed them. Some years ago, when first stationed at Gibraltar, I saw a very large male monkey in captivity at the signal station. He had been captured in one of the ammunition boxes in the enclosure, baited with fruit. It had taken the united efforts of three artillerymen, who rushed upon him with their cloaks, to secure him. After a while he got reconciled to his fate, but from his position, chained to the wall and overlooking the eastern precipice, he was always scanning the cliffs in great apparent anxiety and fear, which was quite unmistakable when his late comrades appeared in sight. If he had rejoined them he would probably have been torn in pieces. In June 1874,' says Sergeant Brown, 'a fire broke out on a Sunday after-

noon, and a strong southwest wind carried it up the slope of the cliff. . . . The monkeys seemed in great distress while the fire was raging, and a full-grown one was missed afterwards, but several births kept up the total. In the spring of 1875 the troop consisted of six full-grown females and two large males, with several young ones. One of the males was very mangy, had a bowed back, and appeared very old; the other, a full-grown powerful monkey, I should judge to be nearly 3 feet long in the body, and standing nearly 5 feet high when stretched up. He was lord of the tribe, kept it in order by chasing or biting any refractory member, and took the lead when shifting from one side of the rock to the other, which they usually did a few hours before the wind changed. I missed the large male on August 7th, 1875, and in the beginning of September he was found dead.' The death of this monkey seems to have been a serious blow to the community, for writing again on the last day of 1877 Sergeant Brown says, 'There are now four very large adult females, four younger and rather smaller, four females and one male of middle size, probably four years old, and five small ones just entering on their third year. I think there are four females and one male, but am not certain yet. There have been no births since 1875. They still travel together from place to place, but straggle more, and seem to squabble more among themselves since the old male died.'

"In a letter, May 3rd, 1880, the sergeant says, 'The monkeys are all doing well; the young male born in 1874 is now master of the troop. There were four young ones last spring, two of which had about an inch rudiment of tail. I expect seven or eight births this summer. One large female was found by a laborer on May 20th, 1879, looking very sick; he gave it some coffee, but it died; its breasts were full of milk, and it had probably just given birth to a young one, which was not found. Last July I saw two full-grown females, each with a young one; they sat down close to each other on the path, and were chattering and examining one another's young, when the male monkey came and sat down between them, and all three were chattering away together for several minutes. Through the summer the male was nearly always carrying one or the other of the young ones.'

"Sometimes a fight occurs among the monkeys, when it is surprising to witness the rapidity with which they will follow an offender down the stupendous precipice of the eastern face; tumbling one after another, and catching at bits of bush or projecting ledges on their way, they descend hundreds of feet in a moment or two. Sometimes the sergeant dresses wounds on them, probably from this cause, but they soon heal up."

In captivity the magot, at least during youth, is lively, active, intelligent, and good-tempered; but with advancing years it becomes sullen and capricious, and finally spiteful and capricious. The French naturalist, Frederic Cuvier, observes that the natural instinct, which causes these monkeys when in a wild condition to associate together in troops, leads solitary individuals in confinement to make friends of such animals as they are thrown in contact with. Such animals, if sufficiently small, are carried about by the magots, who express their satisfaction by hugging and caressing their burdens, and become furious when any attempts are made to remove them.

The magot is perhaps brought oftener to Europe than any other monkey ; its native climate being such as to permit of its existing with tolerable comfort in more northerly regions.

EXTINCT MACAQUES

Under the heading of the magot, incidental reference has been made to the occurrence of fossil species of macaques, but as this is a subject of considerable interest in regard to the present geographical distribution of these monkeys, we must say a few words more. Asia being the headquarters of the group, it would only be naturally expected that we should find these monkeys represented in a fossil state on that continent. As a matter of fact, with the exception of India, we know comparatively little of the geology of Asia. In India, however, fossil remains of macaques are found in the caverns of Madras, and in certain deposits of comparatively late age in the Punjab which belong to that epoch of geological history known as the Pliocene.

In Europe fossil macaques occur in fresh-water deposits belonging to the same Pliocene period, both in the south of France, in Switzerland, and also in the north of Italy, in the valley of the Arno. The occurrence of these extinct monkeys need not imply any very great change of climate in those regions. The case is, however, very different with the single fragment of the jaw of a macaque which has been found fossil in our own country, near the village of Grays, in Essex, in strata which belong to the latest or Pleistocene epoch of geological history. This monkey must have lived in England during the time when man had already made his appearance ; and there is no reasonable doubt that the climate must then have been considerably milder than it is at the present day, since it is impossible to imagine that monkeys could survive our English winters, even if they could find a living in our woods during the summer. We have already mentioned that these extinct European macaques may be those from which the magot has taken origin.

In addition to these extinct macaques, there occur in the Pliocene rocks of Attica and the south of France other monkeys which appear to indicate a transition from the macaques to the langurs. These monkeys, which are respectively known as the mesopithecus and the dolichopithecus, have indeed short and stout limbs like those of the macaques, but skulls resembling those of the langur. Unfortunately we shall never know the structure of their soft parts, so that their exact relationships cannot be determined.

THE BLACK APE

Genus *Cynopithecus*

The Island of Celebes is remarkable for possessing several altogether peculiar types of Mammals, among which is the so-called black ape (*Cynopithecus niger*), the sole representative of a genus in some respects connecting the preceding group

of the macaques with the following one of the baboons. It was represented many years ago by one living example in the old menagerie at the Tower, and by another in that of Exeter Change. At that time, however, the true habitat of this animal was quite unknown, Cuvier suggesting that it came from the Philippines; but its home was subsequently found to be Celebes. This monkey, which is shown in the accompanying figure, is a decidedly handsome animal, the whole of the fur, as well as the naked parts of the face, hands, and feet, being of an intense black, the only exception to this coloration being the large callosities on the buttocks, which are flesh colored. The hair of the body is long and woolly, but that on the limbs



THE BLACK APE.
(One-sixth natural size.)

shorter. The tail is represented by a mere tubercle, not more than an inch in length. The face is characterized by the marked protrusion of the muzzle, which is abruptly terminated, the nostrils opening obliquely, and placed some distance behind the extremity of the muzzle. It is this position of the nostrils which connects this monkey with the macaques, and distinguishes it from the true baboons, in which they are situated at the very end of the still more produced muzzle. The sides of the face have the peculiar longitudinal swellings characteristic of the latter, and the cheek pouches are very capacious. On the top of the head the black ape

has a broad tuft of long hairs, curling backward, and forming a very characteristic crest.

The earlier specimens of this monkey brought to England are described as being rather violent in temper, and tyrannizing over the other monkeys with which they were placed in company. Others, however, are stated to have been more gentle in disposition, and thus very different from the fierce baboons. But few specimens of this monkey have been exhibited of late years in the London Zoological Society's Gardens.

Dr. F. H. Guillemard, in his *Cruise of the Yacht Marchesa*, states that his party found the black ape very common in the forest near Wallace Bay, in Celebes; and describes these animals as swinging from bough to bough in small flocks. This monkey is also found in the small Island of Batchian, lying to the eastward of Celebes, and forming a part of the Molucca group. On account of the circumstance that none of the other Mammals of Celebes extend to Batchian, Mr. Wallace is inclined to consider that the black ape "has been accidentally introduced by the roaming Malays, who often carry about with them monkeys and other animals. This is rendered more probable by the fact that the animal is not found in Gilolo, which is only separated from Batchian by a very narrow strait. The introduction may have been very recent, as in a fertile and unoccupied island such an animal would multiply rapidly." In its arboreal habits, and predilection for fruit, the black ape is essentially a macaque, and not a baboon.

THE GELADA BABOON

Genus *Theropithecus*

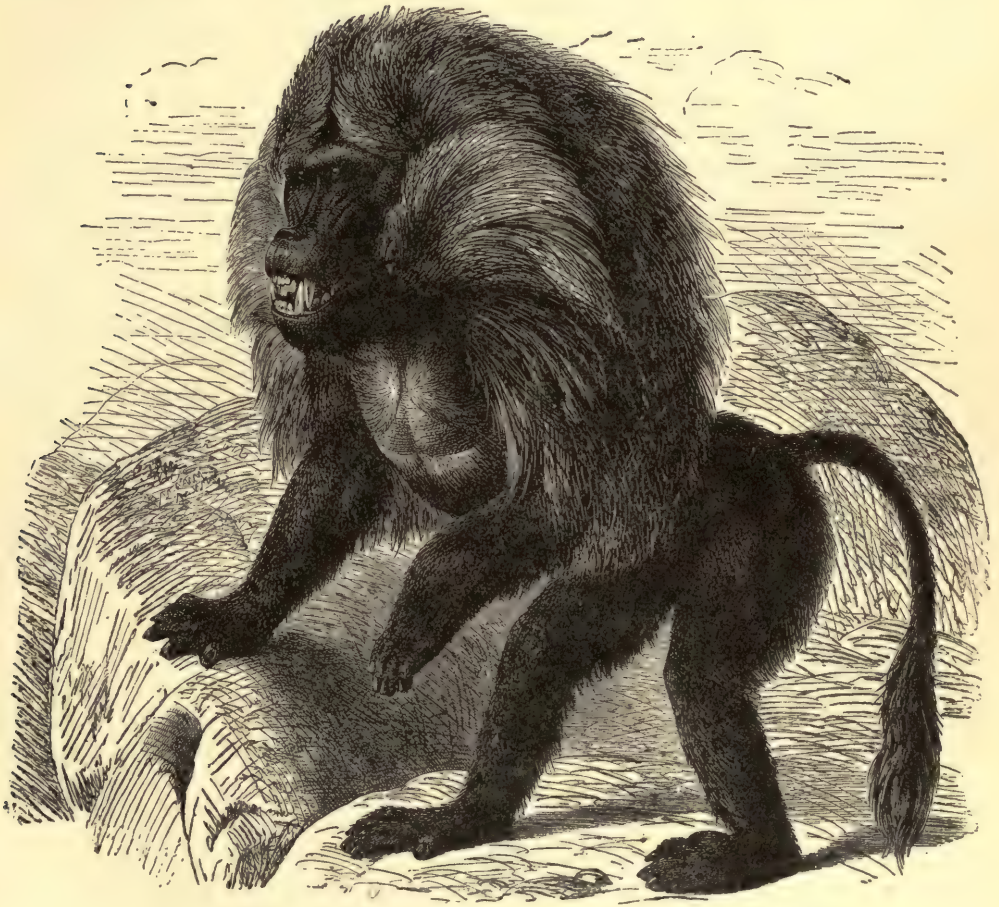
The extraordinary looking animal represented in the accompanying woodcut is our first example of the group of baboons, or dog-faced monkeys, so called from the great prolongation of their muzzles, which far exceeds that obtaining in the black ape, and gives to them an expression quite different from that of any other member of the order. We reserve our remarks for the other peculiarities of the baboons till we come to the more typical representations of the group mentioned under the next generic heading, and here content ourselves with indicating the chief characteristics of the species represented in the illustration on p. 123.

The gelada (*Theropithecus gelada*) is an inhabitant of the southern parts of Abyssinia, and is distinguished from the true baboons by the circumstance that the nostrils are placed some distance behind the extremity of the snout. In this respect, therefore, the gelada forms a connecting link between the black ape of Celebes and the true baboons.

This animal is of comparatively large size, and of a dark color; the shoulders, back, rump, and fore-arms, as well as all the naked parts, being of a deep black, whereas the head, whiskers, neck, and sides are of a sooty gray, sometimes tinged with brown. The most peculiar feature about the creature, is, however, the great

mantle of long black hair growing from the neck, and flowing over the shoulders. The chest is naked, while the moderately long tail is cylindrical, and furnished with a long black tuft at the end.

Taken altogether the aspect of the gelada forcibly suggests a large black poodle dog, with an unusually abundant mane. A good account of the habits of this baboon has been given by Dr. Rüppell, who traveled many years ago in Abyssinia.



THE GELADA BABOON.
(One-eighth natural size.)

From this it appears that its mode of life is very similar to that of the true baboons. The geladas live in large troops, and are especially addicted to rocky regions, whence they descend to plunder the cultivated grounds of the natives, occasionally entering into conflict with troops of the Arabian baboons.

A few examples of the gelada have been exhibited from time to time in the Gardens of the London Zoological Society.

THE TRUE BABOONS

Genus *Cynocephalus*

With the true baboons we come to the most hideous and repulsive-looking members of the order of Primates; their repulsive appearance being only equaled by the fierce and untamable disposition of several of the group. A party of these creatures is shown among their natural surroundings in our colored plate.

All the baboons are confined to Africa and the countries lying on the north of the Red Sea, so that they are totally absent from the Oriental region. They are found over the whole of Africa; but, as is so generally the case, are represented by a greater variety of species on the west coast than elsewhere, and it is also in that region that the most hideous representatives of the group are to be found. Next to the Man-like Apes, the baboons include the largest members of the Primates, some of the species being as large as a pointer dog.

While agreeing with the gelada baboon in the great length of their snouts, the true baboons are readily distinguished from that species by the nostrils being placed at the very extremity of their snout; indeed, in the Arabian baboon they actually project slightly beyond the upper lip, as is the case in most dogs. This canine form of countenance led the ancient Greeks and Romans to apply the name *Cynocephali* (dog-headed) to these animals; and it is this name which has been adopted in scientific phraseology as the distinctive appellation of the group. This great prolongation of the snout shows that the baboons are the lowest of the Old World monkeys, and they bear the most marked signs of relationship with the inferior orders of Mammals.

In addition to their long snouts, baboons are likewise distinguished by the large proportionate size of their skulls, this being most markedly the case with some of the West African forms. Moreover, the bones forming the upper jaws are greatly inflated, so as to give a swollen look to this part of the face in some of the species. They may also carry prominent oblique ridges, which form the support for the peculiar fleshy tumor-like structures occurring in certain West African examples.

In all the baboons the callosities on the buttocks are unusually large, and may be very brightly colored. The tail is never very long, and may be short. The arms and legs, or, as they may be better termed, fore and hind-legs, are nearly equal in length, and thus far better adapted for progress on the ground than for climbing. Indeed, none of the baboons appear to be adepts at climbing, and many of them pass almost their whole time on the ground. As we shall have occasion to notice more fully later on, several species of this group show an especial predilection for rocky ground, and are accustomed to go in large troops—this association being probably necessary for defense against the attacks of leopards and other carnivores, to which their terrestrial habits render them peculiarly liable.

Their defense does not, however, rest solely on the strength of numbers; for the male baboons, which are considerably superior in size and strength to their consorts,

are armed with tusks of the most formidable dimensions. Indeed, a bite from one of these animals must be almost, if not quite, as severe and dangerous as a leopard's; and there are instances on record where leopards have been successfully attacked and mastered by a few old male baboons.

The great size of the head, coupled with their general bodily conformation, renders all the baboons much less capable of assuming and maintaining the erect posture than any of the other Old World monkeys. They are, indeed, accustomed to go almost invariably on all fours; and when on tolerably flat ground can gallop at a pace that requires a horse to overtake them. When brought to bay, a baboon will, however, stand on its hind-quarters to defend itself more readily.

Habits In the wild state scarcely any kind of food comes amiss to baboons; and although the bulk of their nutriment may take the form of seeds, fruits, roots, and the gum which exudes from the stems of many of the African acacias, they also search for and eat insects, lizards, and birds' eggs. In regions where cultivated lands exist much harm is done by the nocturnal excursions of baboons. During such raids most travelers agree in saying that a certain number of the troop are selected to act as sentinels and to give timely warning of the approach of an enemy. How much credence is to be given to the statements that on these occasions the marauders are accustomed to range themselves in long lines leading from the cultivated ground to their homes, and to pass the stolen plunder from hand to hand, it is not for us to decide.

In disposition all the baboons are the reverse of amiable, and they are accustomed to fly into paroxysms of fury at any object which enrages or excites them; but some of the species are capable of being more or less completely tamed, and even learning a certain number of tricks; and it appears that members of one species were habitually tamed by the ancient Egyptians.

We shall have occasion again to refer to the early period at which baboons must have been known to the Egyptians, and we have already mentioned that they take their scientific name from their ancient Greek title. To show that they were known in Europe at least two centuries ago, we extract an account which, though often quoted, is so interesting and so quaint that it will bear another repetition. This work is by one Ludolph, and relates to the ancient Ethiopia, the modern Abyssinia; the English translation being published in the year 1684. "Of apes," writes Ludolph, "there are infinite flocks up and down in the mountains, a thousand and more together; there they leave no stone unturned. If they meet with one that two or three cannot lift, they call for more aid, and all for the sake of the worms that lie under; a sort of diet which they relish exceedingly. They are very greedy after emmets. So that having found an emmet-hill, they presently surround it, and, laying their fore-paws with the hollow downward upon the ant-heap, as fast as the emmets creep into their treacherous palms, they lick 'em off with great comfort to their stomachs; and there they will lie till there is not an emmet left. They are also pernicious to fruit and apples, and will destroy whole fields and gardens unless they be carefully look'd after. For they are very cunning, and will never venture in till the return of their spies, which they send always be-

fore ; who giving information that all things are safe, in they rush with their whole body, and make a quick dispatch. Therefore they go very quiet and silent to their prey ; and if their young chance to make a noise, they chastise them with their fists ; but if they find the coast clear, then every one hath a different noise to express his joy. Nor could there be any to hinder them from further multiplying, but that they fall sometimes into the ruder hands of the wild beasts, which they have no way to avoid but by a timely flight, or by creeping into the clefts of the rocks. If they find no safety in flight, they make a virtue of necessity, stand their ground, and, filling their paws full of dust or sand, fling it into the eyes of their assailant, and then to their heels again."

Although Ludolph may have mixed up some other monkeys with them, there can be little doubt but that in the main this marvelous account refers to the Arabian baboon, which is still so common in Abyssinia. This identification is strongly supported by his mention of the large number of individuals in a troop, by the reference to rocks, by the search after insects, and also by the allusion to encounters with leopards. It must, however, be confessed that the figures of monkeys with which Ludolph's narrative is illustrated, bear but little resemblance to baboons, although this may well be explained by the degree of license which the engravers of his epoch seem to have allowed themselves in such matters.

We now proceed to notice in detail the better known of the various species of baboons, commencing with the more typical ones with comparatively long tails, and concluding with the others, like the drill and mandrill, in which these appendages are reduced to their smallest dimensions. Our first example will be

THE ARABIAN OR SACRED BABOON (*Cynocephalus hamadryas*)

The Arabian, or sacred baboon, is the species so commonly represented on the ancient monuments of Egypt, and may be easily recognized by its generally ashy-gray color, and the large mane with which the neck and shoulders of the males are covered, as is well shown in our illustration. The males of this species are about as large as a good-sized pointer dog. The tail is of considerable length, and terminates in a tuft of long hair. The face has long whiskers of a slaty color, and is itself, like the ears, flesh colored. The hands are black, and the large naked callosities on the buttocks bright red. The shaggy mane on the neck and shoulders of the males extends backward over a considerable portion of the body, and all the hairs are ringed with different colors, so as to produce that speckled appearance common to so many African monkeys. The females and young are quite devoid of this mane ; the former being nearly as large as the males. The snout is very long, and has not the prominent tumor-like swellings characterizing the short-tailed baboons. The nostrils project somewhat in front of the plane of the upper lip, like those of a dog, and are similarly divided by a vertical furrow. The eyes are surrounded by a light-colored ring, and the whiskers are brushed back so as to cover the ears. If the gelada baboon be rightly compared to a black French poodle, the males of the present species might be still more appropriately likened to a gray one, did such a creature exist.



BABOONS.

The Arabian baboon, as its name implies, inhabits Arabia, but it is more common on the African continent, in Abyssinia and the Sudan. It is not now found in Egypt, but it may have been in ancient times; although, on the other hand, it is quite probable that it may have been imported by the ancient Egyptians from the Sudan. It is just possible that the animal mentioned in the Scriptures under the name of satyr may be this species.



THE ARABIAN BABOON.
(One-eighth natural size.)

Early History Among the ancient Egyptians the baboon occupied a prominent place in the long series of sacred animals, and was consecrated to the god Thoth. When sculptured by itself, it is the male that is represented, and it is always placed in a seated position, with the hands resting on the knees, the mane investing the body like a huge cloak. Hermopolis, the city of Thoth, was especially

devoted to the cult of these animals ; while in Thebes a special necropolis was arranged for the preservation of their mummified bodies. In spite, however, of its sacred character, the ancient Egyptians, if we may trust their sculptors, were not averse to making use of the sacred baboon in the ordinary affairs of life. For instance, there is a bas-relief extant representing a fruit-bearing sycamore, in the branches of which are three monkeys, which from their long snouts, well-developed tails, and thickly-haired shoulders and necks, may be at once recognized as Arabian baboons. On either side of the tree are two slaves, with baskets laden with sycamore-figs, others of which they are receiving from the hands of the baboons. It thus appears that the ancient Egyptians had succeeded in training these intractable animals to gather fruit and hand it to their masters, precisely after the fashion that the modern Malays are said to have trained a langur in Sumatra to perform a similar kind of service ; the fruit in the one case being sycamore-figs, and in the other cocoanuts.

In addition to being represented on the monuments of Egypt, it appears highly probable that of two large monkeys sculptured on a bas-relief on one of the obelisks brought by Sir Henry Layard from Nimroud, the one depicted with a heavy mantle of fur on the shoulders is intended for the Arabian baboon.

Habits Under the general heading of baboons we have already alluded to Ludolph's account of this species in the seventeenth century. There are many later descriptions of the habits of this species, but we shall content ourselves with some of the more recent of these. Mr. Blanford, in his account of the Natural History of Abyssinia, relates his first meeting with these baboons when on the march to Magdala in the following words: "On rising the next morning I saw a singular spectacle. A large troop of baboons, at least two hundred in number, were hunting for any corn dropped upon the ground in the place where the horses had been picketed. They were the first I had seen, though the sight of these uncouth monkeys soon became familiar enough. The species (*C. hamadryas*) is the well-known dog-faced baboon of Northeastern Africa and Arabia, the same which is frequently represented on Egyptian monuments. The male is a most formidable-looking animal, something between a lion and a French poodle in appearance, with long hair over his shoulders and fore parts."

In another part of the same work the writer just quoted observes that in Abyssinia this baboon "was met with everywhere, from the plains around Annesley Bay to the top of the Dalanta plateau, although most abundant, perhaps, in the tropical and subtropical parts of the country. I saw a small herd close to Theodore's old camp at Baba, on the Dalanta plateau, at about nine thousand feet of elevation. In the passes leading from the table-land to the coast, immense numbers were constantly seen, and the animals evidently keep much to the sides of rocky ravines.

"The herds vary in number ; some cannot include much less than from two hundred and fifty to three hundred monkeys of all ages. The old males usually take the lead when the troop is moving, some of them also bringing up the rear ; others placing themselves on high rocks or bushes, and keeping a sharp lookout after enemies. A troop collected on a rocky crag presents a most singular appear-

ance. I several times saw large numbers assembled around springs in the evening in the thirsty Shoho country between Komayle and Senafé. On such occasions every jutting rock, every little stone more prominent than the rest, was occupied by a patriarch of the herd, who sat, with the gravity and watchfulness befitting his grizzled hair, waiting patiently until the last of his human rivals had slaked his own thirst and that of his cattle. Around, the females were mainly occupied in taking care of the young, the smaller monkeys amusing themselves by gamboling about. Occasionally, if a young monkey became too noisy, or interfered with the repose of his seniors, he 'caught it' in most unmistakable style, and was dismissed with many cuffs, a wiser if not a better monkey."

The same writer mentions that the food of this baboon consists mainly of small fruits, berries, and seeds; although young shoots and buds of trees form a portion of its diet. Like the rest of its kind, it avoids forests and trees, and keeps mainly to the open country, preferring rocky spots. When it climbs, it does so in a heavy and ungainly manner, very unlike the active movements of the generality of monkeys. Its movements, when on the ground and in a hurry, partake more of the nature of a steady gallop than the bounding motion of other monkeys.

As Mr. Blanford observes, the association of these baboons in such large troops is doubtless for the purpose of mutual protection. The old males, are indeed, formidable antagonists, and there are many anecdotes of their attacking, or at least threatening, men. From the circumstance that none of the members of the Abyssian expedition were attacked by these animals, Mr. Blanford, is, however, of opinion that it is but seldom that such onslaughts take place. There is one well-authenticated instance of a troop combining to attack a leopard which had carried off one of their number.

We conclude our notice of the species with two accounts given by Sir Samuel Baker's Observations Sir Samuel Baker, when in the Sudan. "Troops of baboons," observes Sir Samuel, "are now exceedingly numerous, as, the country being entirely dried up, they are forced to the river for water, and the shady banks covered with berry-bearing shrubs induce them to remain. It is very amusing to watch these great male baboons stalking majestically along, followed by a large herd of all ages, the mothers carrying the little ones upon their backs, the latter with a regular jockey-seat riding most comfortably, while at other times they relieve the monotony of the position by sprawling at full length and holding on by their mothers' back hair. Suddenly a sharp-eyed young ape discovers a bush well covered with berries and, his greedy munching being quickly observed, a general rush of youngsters takes place, and much squabbling for the best place ensues among the boys; this ends in great uproar, when down comes a great male, who cuffs one, pulls another by the hair, bites another on the hind-quarters just as he thinks he has escaped, drags back a would-be deserter by his tail and shakes him thoroughly; and thus he shortly restores order, preventing all further disputes by sitting under the bush and quietly enjoying the berries by himself. These baboons have a great variety of expressions, that may perhaps represent their vocabulary. A few of these I begin to understand, such as the notes of alarm and the cry to direct attention; thus, when I am sitting alone beneath the

shade of a tree to watch their habits, they are at first not quite certain what kind of a creature I may be, and they utter a peculiar cry to induce me to move and show myself more distinctly."

On another occasion when a troop of about a hundred of these baboons were observed gathering gum from the mimosa trees, Sir Samuel Baker was asked by the natives whether Lady Baker would like to have a girrit, as these creatures are called by the Arabs of the Sudan. "Being answered in the affirmative, away dashed the three hunters in full gallop after the astonished apes, who, finding themselves pursued, went off at their best speed. The ground was rough, being full of broken hollows covered scantily with mimosas, and the stupid baboons, instead of turning to the right into the rugged and steep valley of Settite, where they would have been secure from the agageers [swordsmen], kept a straight course before the horses. It was a curious hunt. Some of the very young baboons were riding on their mothers' backs; these were now going at their best pace, holding on to their maternal steeds, and looking absurdly human; but in a few minutes, as we closely followed the Arabs, we were all in the midst of the herd, and with great dexterity two of the agageers, while at full speed, swooped like falcons from their saddles, and seized each a half-grown ape by the back of the neck, and hoisted them upon the necks of the horses. Instead of biting, as I had expected, the astonished captives sat astride of the horses, and clung tenaciously to the necks of their steeds, screaming with fear. The hunt was over, and we halted to secure the prisoners. Dismounting, to my surprise the Arabs immediately stripped from a mimosa several thongs of bark, and having tied the baboons by the neck, they gave them a merciless whipping with their powerful coorbatches of hippopotamus hide." This cruel treatment, which was eventually stopped by Sir Samuel Baker, was intended to make the unfortunate baboons docile, and prevent their biting.

The doguera baboon (*C. doguera*) is a closely allied species or variety, also found in Abyssinia. It is of a more olive color than the sacred baboon. Dr. Anderson describes a male preserved in the Museum at Calcutta as being of a uniform yellowish-olive color on the whiskers and all over the body, above and below, except on the hands and feet, which are nearly black. The coarse hair on the fore part of the body is about 6 inches in length, and is ashy-gray in color for the first 2 inches, while the remainder is banded with nine rings of orange and black.

THE CHACMA BABOON (*Cynocephalus porcarius*)

The species last noticed is an inhabitant of the countries bordering on the Red Sea littoral and the Upper Nile valley, but to reach the habitat of the chacma, or pig-tailed baboon, we have to travel to the southern extremity of the African continent. The name Chacma, it may be observed, is a somewhat euphonized rendering of the word T'chackamma, by which the Hottentots of South Africa designate this animal.

Like all the remaining representatives of the long-tailed baboons, the chacma differs from the Arabian baboon by the absence of the mane on the neck and

shoulders of the males. We have, indeed, in this respect a gradual descending series from the gelada baboon, in which both sexes are maned, through the Arabian baboon, in which only the males are so ornamented, to the chacma, in which both males and females are maneless. In size the chacma is one of the largest of the group, and it has been compared in this respect, as well as in its bodily strength, with an English mastiff.

The general color of this animal is grayish black ; but there is often a kind of greenish reflection in the fur when seen in certain lights. The head, as well as the hands and feet, are deep black ; while the small whiskers on the sides of the face, which do not conceal the ears, are grayish. All the hair of the body is com-



THE CHACMA BABOON.
(One-eighth natural size.)

paratively long and shaggy ; while that on the nape of the neck, more especially in old males, forms a slender crest. The roots of the hairs are dun colored, but their extremities are ringed. The tail differs from that of the Arabian baboon by the absence of any distinct tuft at the end. The muzzle is perhaps even more prolonged than in the last-named species ; but the nose is similarly extended beyond the upper lip. The naked callosities on the buttocks are smaller than is generally the case among the baboons. The naked part of the face is of a purplish hue, with the exception of a white ring round each eye, and the whole of the upper eyelids, which are likewise white. In the latter point, curiously enough, this species

resembles the African mangabey monkeys already described. Like the other members of this group of baboons, the chacma carries its tail at first curved somewhat upward, and then hanging straight down.

The chacma, like its cousin the Arabian baboon, is essentially a dweller in mountainous districts, and is found in all the mountain ranges of the Cape district, such as the Snieuweg and the Drachenfels. How far it extends to the northward we have not been able to ascertain, since, as we have already had occasion to mention, travelers and sportsmen are, as a rule, very reticent on the subject of monkeys and their kindred.

Habits The habits of this species appear to be very similar to those of its North African cousin, since we read that it goes in large troops, the members of which scramble up the rocks when their territories are invaded, and, having gained a safe refuge, seat themselves gravely down to gaze upon the strangers. In climbing up the rocky cliffs they are often much assisted by the tendrils of the creeping plants with which so many of the South African crags are clothed. Writing of the kind of scenery among which these animals dwell, the great African hunter, Gordon Cumming, says: "I continued my march through a glorious country* of hill and dale, throughout which water was abundant. Beautifully wooded hills and mountains stretched away on every side; some of the mountains were particularly grand and majestic, their summits being surrounded by steep precipices and abrupt parapets of rock, the abodes of whole colonies of black-faced baboons, which, astonished to behold such novel intruders upon their domains, leisurely descended the craggy mountain sides for a nearer inspection of our caravan." It is said that there are instances where these animals have rolled down stones from the heights on a passing caravan, although there is no proof that such missiles were not merely fragments of rock accidentally detached.

The late Professor Moseley, who fell in with chacmas when at the Cape, during the *Challenger* expedition, states that they "live especially about the sea cliffs and steep slopes leading down from there to the sea; but they are to be met with also on the open moorland above. They live in droves or clans of thirty, forty, or even up to seventy; and there were three such bodies of them in the country immediately about Simon's Bay, and in the tract stretching down to Cape Point. When on the feed, two or three keep watch, and one usually hears them before one sees them. The warning cry is like the German *hoch*, much prolonged. As soon as they see one, three or four of them mount on the scattered rocks so as to have a clear view over the bushes and heaths, and watch every movement of the enemy, so that it is extremely difficult to get within shot of them. If one stands still, or does not go any nearer, merely passing by, they employ themselves, as they sit unconcernedly, in scratching in the usual monkey fashion, but still never losing sight of their object of suspicion.

"Once I came across a troop suddenly, on looking over a low cliff. They dashed off at a tremendous pace, galloping on all fours, till far out of shot, when they climbed up on a rocky eminence, and calmly sat down to watch me. The baboons live on roots, which they dig up, and on fruits, and they turn over the

stones to look for insects and such food underneath. It is striking thus to see monkeys roaming about on open moorland, where there are no trees.

"The track of the baboons on the sand is unmistakable. The foot makes a mark where the animal has been galloping, just like that of a child's foot; the fore-limb makes a mark not half so deeply indented, the hand being used merely to touch on, as it were, to prepare a fresh spring with the feet. I found the skeleton of one of the baboons in a cave at Cape Point. The animal had evidently crawled into the cave to die."

Mrs. A. Martin, in *Home Life on an Ostrich Farm*, also gives an excellent description of the habits of the chacma in the Cape district, from which the following extracts are taken: "On mountain excursions," writes this lady, "you frequently hear his surly bark, and sometimes see him looking out defiantly at you from behind a rock or bush, where possibly you have disturbed him in the midst of an exciting lizard hunt, or careful investigation of loose stones in search of the centipedes, scorpions, and beetles hidden beneath. These creatures, uninviting though they appear to us, are among his favorite dainties, and he catches them with wonderful dexterity. In the silence of night his voice is so distinctly audible from the homestead that you would imagine him to be close by, though in reality he is far off in one of the *kloofs* of the mountains. One night, as we strolled up and down near the house, enjoying the bright moonlight, a loud chorus of distant baboons, to which we were listening, was suddenly interrupted, evidently by the spring of a hungry leopard, the moment's silence being followed by the agonized and prolonged yells of the victim. . . . No vegetable poison has the slightest effect on the baboon's iron constitution; and, indeed, if there exists any poison at all capable of killing him, it is quite certain that, with his superior intelligence, he would be far too artful to take it; and when the fiat for his destruction has gone forth, a well-organized attack has to be made on him with dogs and guns. He can show fight, too, and the dogs must be well trained and have the safety of numbers to enable them to face him; for in fighting he has the immense advantage of hands, with which he seizes a dog and holds him fast, while he inflicts a fatal bite through the loins. Indeed, for either dog or man, coming to close quarters with Adonis [as the chacma is ironically called by the Boers] is no trifling matter. One of our friends traveling on horseback, came upon a number of baboons sitting in solemn parliament on some rocks. He cantered towards them, anticipating seeing the ungainly beasts take to their heels in grotesque panic; but was somewhat taken aback on finding that, far from being intimidated by his approach, they refused to move, and sat waiting for him, regarding him the while with ominous calmness. The canter subsided into a trot, and the trot into a sedate walk, and still they sat there; and so defiant was the expression on each ugly face that at last the intruder thought it wisest to turn back and ride ignominiously away."

The most general food of the chacma is afforded by the bulbous roots of an iris-like plant, known as *ixia*, of which there are several South African varieties, one of which is specially known as the baboon's *ixia*. These bulbs the chacmas dig up with their strong hands, and carefully peel before eating. Other kinds of bulbous and tuberous roots are also eaten by these animals; while buds and young

twigs form a less important part of their food. In addition to this vegetable diet, the chacmas also search for and devour various kinds of insects and allied animals, such as locusts and scorpions; the latter being carefully deprived of their stings before being consumed. Lizards and frogs are dainties less commonly eaten; while birds' eggs, together with various worms and grubs, practically complete the chacma's bill of fare.

These baboons are well represented in all menageries, where they thrive well. When young they are fairly tractable, but their temper steadily deteriorates with advancing age.

THE ANUBIS BABOON (*Cynocephalus anubis*)

Although there existed for a long period much uncertainty as to their true habitat, it is now definitely known that the whole of the five species of baboons remaining for consideration are, with one exception, confined to the western side of Africa, and are therefore compatriots of the chimpanzee and the gorilla. It is probable, indeed, as we have already mentioned, that it was one of the short-tailed kinds that was met with in Hanno's voyage.

The anubis baboon, together with the two following species, may be readily distinguished from the chacma by the circumstance that the hairy parts of the hands and feet are of the same color as the hair of the back, instead of being black. The general color of the present species is olive green, whence it is sometimes known as the olive baboon. There is a small crest on the nape of the neck; and the hairs are gray near the roots, and ringed with black and yellow at the tips.

Habits The habits of these baboons appear to be much the same as those of the other species of the genus. They go in troops, and inhabit rocky, mountainous regions, being especially common at a place some two hundred miles in the interior of Angola, known as the Black Rocks. Away from the river valleys the country is arid in the extreme, and it is these thirsty districts which are the chosen abode of the baboons. Here they subsist largely on that very remarkable kind of West African plant known as the *welwitschia*. So remarkable is this plant, that we may venture to briefly describe it. The *welwitschia* is a plant which in its earlier stages of growth consists of the two ordinary seed leaves. These appear to grow considerably, and extend horizontally outwards in opposite directions, raised but little above the surface of the sand, whilst the intervening stock thickens and hardens, assuming a somewhat conical shape, flattened at the top, and rapidly tapering below into the roots. In time the original pair of seed leaves, having attained their full size, and acquired a hard and fibrous structure, instead of dying, gradually split up into shreds; at the same time the woody mass upon which they are borne, although rising but little in height, increases in width both above and below the insertion of the leaves, so as to clasp their bases in a deep slit on the margin. Every year several short flowering stalks are developed from the upper side of the base of the leaves. Each of these stalks forms an erect jointed stem, dividing in a fork-like manner, varying in height from six to twelve inches, and carrying at the end of each branch a cone, with the flowers and seeds beneath its scales. The result is

that the country is studded with these tabular or anvil-like masses of wood, whose flat tops, pitted with the scars of old flower stems, never rise to more than a foot above the ground, but vary, according to age, from a few inches to upwards of five or six feet in diameter. Even those which are not more than eighteen inches in diameter are supposed to be fully a century old, although still retaining their original seed leaves, which, albeit torn and tattered by the wear and tear of time, are, when entire, fully six feet in length. It is upon the stems and exposed portions of these extraordinary plants that the anubis baboons feed; tearing and ripping the woody tissue with their powerful tusks.

THE YELLOW BABOON (*Cynocephalus babuin*)

Our next example of this group is the yellow baboon, represented in the figure on the next page, and also on p. 64. This species may be distinguished from the preceding by the absence of a crest of hair on the nape of the neck, and likewise by its coloration. It takes its popular name from the pale brownish-yellow hue of the fur, which is rather darker on the sides of the back than elsewhere, while it tends to a whitish tint on the cheeks. The hair on the crown of the head is somewhat elongated. As in the anubis baboon, the hairy parts of the hands and feet agree in color with the body; but the naked parts of the face, hands, and feet are, as in the other members of the group, of a deep black.

It was long thought that the yellow baboon came from Nubia and the Sudan; it is now known to occur on the West Coast; but according to Mr. H. H. Johnston, there is a baboon found in the neighborhood of Kilima-Njaro, on the East Coast, which he provisionally identifies with this species. He states that these baboons generally frequent the outlying parts of the plantations of the natives, subsisting largely on the maize and other products stolen therefrom. In certain localities they are extremely numerous, going about in troops composed of about fourteen individuals of both sexes and of all ages. They have but little fear of man, and instead of running away will turn round and face an intruder, with threatening gestures, at a distance of only a few yards. The natives are in the habit of driving them away from the crops, when the baboons retreat in a leisurely manner, with their cheek pouches crammed full, and often dragging off some of the plunder in their hands. In one instance it is related that a troop of these animals pursued a native lad for some time, until he had placed a river between himself and his pursuers. On another occasion Mr. Johnston relates how he killed a female out of a troop of baboons he encountered in these districts, who received him with snarlings and other expressions of hostility. After taking the carcass home, he proceeded to cook and eat a portion of it, and although he states that he found the flesh succulent and palatable, we venture to think that his example will not be generally imitated by those who follow in his footsteps. As we shall see later on, the natives of Guiana are in the habit of eating roast monkey—or at least they were so in the time of Humboldt.

THE GUINEA BABOON (*Cynocephalus sphinx*)

There are few species of Mammals that have given rise to more confusion in Natural History literature than this one, of which examples have been described under at least two distinct names, and regarded as different species, though it is a



THE YELLOW BABOON.
(One-sixth natural size.)

well-ascertained fact that the common baboon, or papio, belongs to one and the same species as the sphinx, or Guinea baboon.

The Guinea baboon is characterized by the uniformly reddish-brown color of its fur, which is washed with a yellowish tinge, more especially upon the head, shoulders, back, and limbs; the cheeks and throat being paler, and the whiskers fawn colored. As in the chacma, the upper eyelids are white. The nose projects rather

beyond the upper lip, but is somewhat less elongated than in the chacma, and has small swellings corresponding to those so enormously developed in the next species.

As its name indicates, it is an inhabitant of Guinea; and although, judging from the number of specimens that are imported into Europe, it must be common, we have no record of its habits and mode of life in a state of nature. Of those in a state of confinement we have, however, numerous accounts, from the time of Buffon downwards; the species being frequently carried about by itinerant showmen.

THE MANDRILL (*Cynocephalus mormon*)

With the hideous creature represented in the figure on the next page we come to the first of two West African species of baboons, distinguished from all those we have hitherto considered by the reduction of the tail to a short stump, and also by the long tuberculous swellings on either side of the muzzle, which communicate the peculiarly hideous expression to the face. Moreover, the whole head is larger in proportion to the body than in the other baboons, and as the fore-quarters also appear to be relatively higher in proportion to the hinder parts, the general appearance is ungainly in the extreme. In fact, the whole appearance is far more suggestive of the forms imagined during a nightmare than is the case with any other living Mammal.

It has been suggested by several naturalists that these two species ought to be separated from all the other baboons in a genus by themselves; and the late Dr. Gray even went so far as to make each of them the type of a distinct genus. This separation is, however, uncalled for, since both are true baboons in all essential characteristics; the small size of the tail being merely analogous to the condition which we have seen in certain members of the macaque monkeys, while the huge swellings on the face are only exaggerated developments of the smaller ones found in the Guinea baboon.

The mandrill, as the species represented in the accompanying illustration is called, is the largest of all the baboons, and is, in truth, a brute of tremendous power and ferocity. Its leading characteristics as a species are to be found in the circumstance that its short and tuberculous tail has its under surface naked, and that the swellings on the face are ornamented with a brilliant coloration in the adult state, and are of enormous dimensions.

From the great development of these swellings on the sides of the muzzle, Pennant gave to the mandrill the name of rib-faced baboon, but this has generally been discarded by modern writers in favor of the former term. And here we may take the opportunity of mentioning that, according to the investigations of Professor Huxley, the name mandrill seems to signify a man-like baboon; the term drill being an old English word of which one meaning denotes a baboon or ape.

The limbs of the mandrill are characterized by their relative shortness and powerful build, and in correlation with these the form of the body is likewise powerful and robust. The ugly and massive head has scarcely any distinct forehead, the

profile sloping almost uninterruptedly upwards from the muzzle to the occiput. The nose, instead of projecting in front of the upper lip, as in the sacred baboon, is somewhat truncated; while the projecting eyebrows and deeply sunk eyes communicate a forbidding expression to the whole countenance. The tubercular swellings on either side of the muzzle are supported on ridges arising from the swollen bones of this part of the skull, and are themselves almost the size of a man's fist. As a whole, they are somewhat sausage shaped, and are marked with a series of promi-



THE MANDRILL.
(One-tenth natural size.)

nent transversely disposed ribs of light blue, with deep purple in the grooves, while the middle line and the tip of the nose are scarlet. The contrast between such brilliant colors and the general hue of the fur and the hazel eyes is most marked. The stump of a tail, which, as we have seen, is naked on the under side, is carried erect and bent over the back somewhat after the manner of that of a pug dog. The general color of the fur is a blackish-olive, darker on the crown of the head, the middle

line of the back, the nape of the neck, and the flanks; and lighter on the cheeks. The summit of the head is crowned with a crest of dark hair directed backwards in a pointed and peaked form, while the chin is ornamented with a small pointed beard of an orange-yellow color. To add to the strange effect of all these varied tints the large naked callosities on the buttocks are of a bright blood-red color. The pointed crest on the crown gives to the whole head a somewhat triangular form; and in harmony with this peculiar contour we find the naked bluish-black ears angulated at their fore-and-aft borders, suggesting the appearance of having been cropped. The truncated muzzle is surrounded by a raised border like that of the swine; from which circumstance it has been considered by some writers that the mandrill is the problematical animal alluded to by Aristotle as *Chæropithecus* (hog-ape), but this identification is by no means certain.

Such are the colors of the adult male mandrill, but the brilliant scarlet of the middle and end of the muzzle is not assumed until the first, or milk set of teeth have been replaced by the permanent series, while at a still younger age the whole of the face is black. Moreover, it is only in the adult of the male sex that the swellings on either side of the snout assume the enormous dimensions we have noticed. In both the young males and in the females of all ages, these swellings are but of moderate dimensions; and in the female they are colored blue only. In correlation with the smaller size of the fleshy swellings, the skulls of females and young males are characterized by the much slighter development of the bony ridges underlying these structures, which form such prominent features in the skulls of old males.

Habits

In the wild state on the western coast of Africa mandrills appear to have habits very like those of other baboons, living in large troops; and on this account, as well as from their size and strength, being exceedingly formidable antagonists. The accounts given by the earlier travelers of their attacking men without being provoked require confirming; and we are in want of full information as to their habits in general.

In confinement the chief characteristic appears to be that the ferocity and moroseness common to the old males of all baboons is intensified. There is also a marked liking for spirituous liquors of all kinds, which is likewise a trait exhibited by other species of the genus. One of the earliest examples of an adult male mandrill exhibited in London was the famous "Jerry," immortalized by Mr. Broderip, which was kept first in the menagerie at Exeter Change, and then transferred to the Surrey Zoological Gardens. This animal had learned to drink daily a pint of porter, which he seemed thoroughly to appreciate, and he had also been taught to smoke tobacco in a short clay pipe, although this accomplishment did not appear to be so much to his taste.

Of late years the mandrill has been represented by a comparatively small number of specimens in the London Zoological Society's Gardens. An extraordinary animal was born in the Society's menagerie in the autumn of 1878, being a female hybrid produced by a cross between a female mandrill and a male of the crab-eating macaque (*Macacus cynomolgus*).

The mandrill is strictly confined to the tropical parts of Western Africa; the Gabun district being perhaps its headquarters.

THE DRILL (*Cynocephalus leucophæus*)

Although described by Frederic Cuvier as far back as the year 1807 as a distinct species, the West African baboon represented in the accompanying figure, and known as the drill had for many years previously, in spite of a figure given by the traveler, T. Pennant, been considered to be merely the young of the mandrill, which had not acquired the characteristic coloration of the face. The



THE DRILL.
(One-sixteenth natural size.)

acquisition of adult specimens of the drill by our museums and menageries proved, however, the correctness of the English and French naturalists' determination. It is exclusively West African, but its range in latitude appears to be somewhat more extensive than that of the mandrill.

It may be distinguished from its larger cousin the mandrill by the absence of any bright colors on the naked parts of the face, which are entirely black. The

short tail is covered with hairs over the whole of its surface; while the general build, and especially that of the limbs, is of a much more slender type. Again, although the face has the long sausage-like swellings of the mandrill, these are considerably smaller and less inflated. The drill is ugly enough, but it is, to our eyes at least, one degree less repulsive than the male mandrill.

The general color of the fur is brown, tending to a whitish tint on the forehead and the crown of the head, and darker on the shoulders and the limbs. The under parts are also lighter, being either of a pale brown or a silvery-gray tint. The hair of the upper parts is very long and fine, and is of a light brown color at the root, but ringed with black and yellow at the tips. These rings of two colors give a greenish tinge to the fur when seen under certain lights. The whiskers are thin and directed backward like those of the mandrill; and the drill also resembles that species in the presence of the peaked crest on the crown of the head, as well as in the small yellow beard beneath the chin. The apology for a tail terminates in a small tuft of hair. The naked jaw and ears are of an ivory-black appearance, and the swellings on the snout are not marked by the oblique transverse furrows and grooves which characterize those of the mandrill. The naked portions of the hands and feet are copper colored, while the bare callosities on the buttocks are bright red. The color of such portions of the skin as are covered with hair is of a uniform dark blue. The female drill is distinguished from her lord and master by her smaller size, and also by the relatively shorter head and paler coloration, in which the young males resemble her.

We have already alluded to the unsatisfactory nature of our knowledge of the mandrill in its wild state, but in the case of the present species our information appears to be absolutely nil. In confinement, however, the drill seems to be very similar in its habits to the mandrill, and there can be no reasonable doubt but that there is the same similarity in the wild condition.

With the drill we conclude our notice of the living monkeys of the Old World; but before passing to those of the New World we must devote a short space to a few extinct baboons.

EXTINCT BABOONS

Our survey of the long series of Old World monkeys has shown us that as we pass from the Man-like Apes through the true monkeys to the baboons, we have been gradually receding further and further from a marked approximation to the human type, until we have reached forms that show a decided resemblance in their projecting muzzles and general contour to the lower orders of Mammals. These lowest forms being the baboons, it is but natural to assume that they are likewise old in the history of the animal kingdom, so that we should expect to find them in a fossil state. In Europe, however, no traces of fossil baboons have yet been discovered; while in Africa we only know of them as occurring in the superficial deposits of Algeria. The latter circumstance must not, however, be taken as an indication that other species of fossil baboons will never be found in Africa, since

our knowledge of the geology of the greater part of that continent is of the most limited nature. We must, indeed, with our present knowledge, travel to the extreme north of India before we obtain evidence of fossil baboons belonging to a period antecedent to that during which man has existed on the globe. And it is in the sandstones forming the outer flanks of the mighty Himalayas, to which we have previously alluded as containing the remains of the extinct Indian chimpanzee and orang, that those of the fossil baboons occur. These rocks, as we have elsewhere stated, belong to the lower part of that division of the Tertiary period which geologists designate the Pliocene. The remains of the Pliocene Indian baboons are, like those of all the Primates, extremely few, yet they are amply sufficient to prove the existence in that country of two distinct species. Both of these appear to have been closely allied to some of the longer-tailed African species; and we may therefore conclude that these Indian species were allied to the sacred baboon or the chacma. There is, moreover, evidence that baboons continued to exist in India to either the early human or Pleistocene period, since a single tooth has been obtained from deposits in a cavern in Madras which has likewise yielded remains of man.

We have, therefore, decisive proof that at a former epoch of the earth's history such an assembly of Primates was gathered together on the plains of India at a time when the Himalayas did not exist, as has been seen nowhere else beyond the walls of a menagerie. Side by side with langurs and macaques closely resembling those now found in that region, were chimpanzees and baboons as nearly related to those of modern Africa; while the extinct Indian orang recalls the existing species of Borneo and Sumatra. India, therefore, in the Pliocene period, seems to have been the central point whence the main groups of Old World Primates dispersed themselves to their far distant homes.

The generalized character, and the large size of the baboons, have suggested, that it is to them we should look as the original ancestral stock from which the Man-like Apes took their rise. There is, however, found in the rocks of the Miocene period (the one immediately antedating the Pliocene) of Europe, a baboon-like ape known as the mountain ape (*Oreopithecus*), which combines to a certain extent the features now characteristic of the Man-like Apes and the baboons. It is this creature, therefore, which we should rather be justified in regarding as the ancestral stock of the Man-like Apes; the baboons being survivors from a still older stock, from which the mountain ape was itself derived.

Whether the relationship which must once have existed between the baboons and the inferior orders of Mammals will ever be revealed to us, is a question which time alone can decide.

CHAPTER V

APES, MONKEYS, AND LEMURS—*continued*

THE AMERICAN MONKEYS

Family *CEBIDÆ*

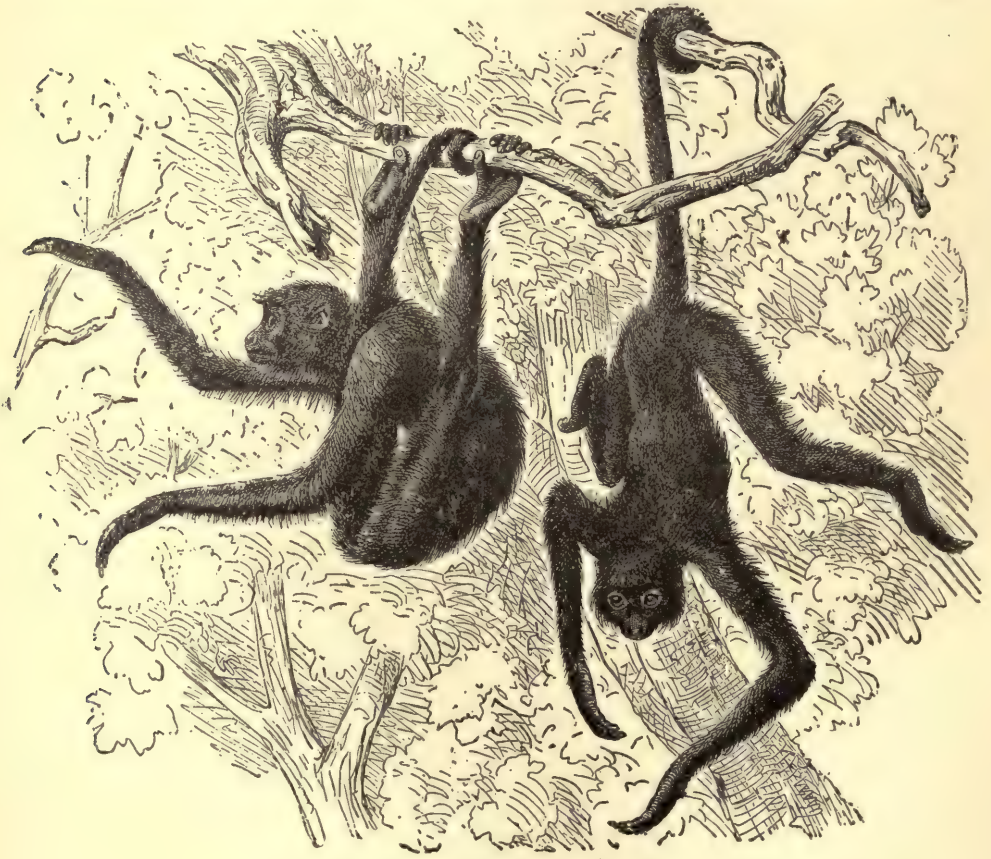
The monkeys of America differ so remarkably from those of the Old World, that they cannot be included in either of the families treated of in the two preceding chapters. The true monkeys of the New World form, indeed, a perfectly distinct family by themselves, known to zoologists as the *Cebidæ*. In addition to these, there is another group of American Primates known as the marmosets, which, although nearly related to the *Cebidæ*, constitute a second family, which will be treated of in the next chapter.

Not only is this distinction between the monkeys of the Eastern and Western Hemispheres a feature characteristic of the present state of the world's history, but, so far as we know, it was the case throughout geological history, for not a trace of a New World monkey has been found in any of the formations of the Old World, while those of the New World have yielded remains of species allied to those now inhabiting the same regions. We have thus decisive evidence that both these groups are of great antiquity; and it has even been suggested that they have taken their respective origins from animals probably allied to the lemurs quite independently of one another.

For a long period zoologists were accustomed to class the apes, monkeys, and baboons of the Old World in one group, to which they applied the name of narrow-nosed monkeys (*Catarhini*), from the circumstance that the partition between the nostrils is a thin one; while the American monkeys and marmosets, owing to the width of this partition, were grouped together as broad-nosed monkeys (*Platyrrhini*). Although there is a certain amount of convenience in this arrangement, it has now, by common consent, been pretty generally abandoned, and the whole of the Primates, exclusive of the lemurs, are divided simply into four families, of which two belong to the Old World and two to the New. In the present chapter we shall take into consideration only the true monkeys (*Cebidæ*) of the New World,—the better known representatives of which are popularly designated howlers, spider-monkeys, sapajous, and titis—as it is to these alone that the term American monkeys should be restricted.

Characteristics Proceeding to notice the characteristics by which these animals are distinguished from their distant cousins of the Old World, we have to mention, in the first place, that no New World monkey has naked callosities on the buttocks. This characteristic will at once serve to distinguish

any American monkey from all those of the Old World, except the larger Man-like Apes, with which there is not the slightest fear of its being confounded. Then, again, all the monkeys of the New World are characterized by the absence of cheek pouches ; so that whenever we see a monkey cramming nuts into his cheeks we may be perfectly sure that he does not come from America. It is true, indeed, that this absence of cheek pouches will not help us to distinguish an American monkey from an Indian langur or an African thumbless monkey, but then both the latter have naked callosities on the buttocks. Moreover, if we were to dissect an American



THE RED-FACED SPIDER-MONKEY.
(One-fifteenth natural size.)

monkey, we should find that it had a simple stomach, quite different from the sacculated one which characterizes the langurs and thumbless monkeys.

Another peculiarity of some, although unfortunately not all, of the American monkeys is that the tail is prehensile, and capable of being coiled round a bough so as to form a most efficient aid in climbing. These prehensile tails are characteristic only of the howlers and the spider-monkeys, and their kin ; the tails of the titis and their allies being nonprehensile, like those of the Old World monkeys. The reader

may note, however, that whenever he sees a monkey swinging suspended by its tail, he may at once put that animal down as an American.

Regarding this peculiar organ of the spider-monkey, Charles Waterton, who traveled so much in South America, writes as follows: "This prehensile tail is a most curious thing. It has been denominated, very appropriately, a fifth hand. It is of manifest advantage to the animal, either when sitting in repose on the branch of a tree, or when in its journey onward in the gloomy recesses of the wilderness. You may see this monkey catching hold of the branches with its hands, and at the same moment twisting its tail round one of them, as if in want of additional support; and this prehensile tail is sufficiently strong to hold the animal in its place, even when all its four limbs are detached from the tree, so that it can swing to and fro, and amuse itself, solely through the instrumentality of its prehensile tail, which, by the way, would be of no manner of use to it did accident or misfortune force the monkey to take up a temporary abode on the ground. For several inches from the extremity, by nature and by constant use, this tail has assumed somewhat the appearance of the inside of a man's finger, being entirely denuded of hair or fur underneath, but not so on the upper part."

A more important feature of the American monkeys, as being common to the whole of them, is the great width of the vertical partition between the two nostrils, of which mention has already been made. This broad partition causes the end of the nose to be much expanded; and a comparison of any of our full-faced figures of the New

World monkeys with those of the Old will show what a marked difference there is in this respect between the two groups.

Another characteristic which we must not omit to notice is that in those of the American monkeys which are furnished with a thumb, this digit cannot be opposed to the other digits of the hand. The American monkeys agree, however, with their



TYPICAL SPIDER-MONKEYS.

cousins of the Old World in having all their digits provided with well-developed nails.

We have left to the last the most important and perfectly constant distinction between the monkeys of the Old and New World, since it is one which can only be observed in the dried skulls. It will be remembered that in our description of the characteristics of the Man-like Apes, it was stated (p. 19) that in these and all the monkeys of the Old World, the total number of teeth was thirty-two. Of these, on each side of both upper and lower jaws, two were incisors, one was a canine, two were premolars, and three molars; the series being expressed by the formula $i_2^2, c_1^1, p_2^2, m_3^3$: total, 32.

If we now examine the skull of any American monkey (always excluding the marmosets) and count the teeth, we shall find that their total number is thirty-six, or four more than in the Old World monkeys. A closer examination will show that the additional tooth on each side belongs to the premolar series—the so-called bicuspid of human dentistry. Thus, whereas all Old World monkeys have but two bicuspid on each side of both the upper and lower jaw, the American monkeys have three of these teeth; and the number of teeth in the latter may accordingly be expressed by the formula $i_2^2, c_1^1, p_3^3, m_3^3$: total, 36.

If we care to carry our examination a little further, we shall not fail to notice that the upper molar teeth of the American monkeys differ very decidedly in the form of their crowns from those of the monkeys of the Old World, so that a single detached specimen of one of these teeth is amply sufficient to decide to which of the two groups its owner belonged. Thus, whereas in the Old World monkeys (exclusive of the Man-like Apes) the crowns of these teeth are tall and narrow, with the four tubercles arranged in pairs nearly at right angles to the long axis, and each tubercle nearly conical, in the monkeys of the New World the crowns of these teeth are much shorter and broader, with their pairs of tubercles arranged obliquely to the long axis; the outer tubercles being much flattened, and the inner crescent-shaped. Those acquainted with the details of anatomy will also find characteristics by which the skulls themselves of the Old and New World monkeys can be mutually distinguished.

Habits Having now shown the leading characteristics by which the American monkeys, as a whole, are distinguished from those of the Old World, we may refer to a few other matters before proceeding to the description of the various species.

In the first place, none of the American monkeys make any approach in point of size to the large Man-like Apes, or even the baboons of the Old World. Then, again, the whole of them are essentially adapted for a purely forest life. Indeed, in the great primeval forests of the Amazon, where the ground is either swampy or entirely under water, the monkeys, together with several other animals, pass the whole of their lives in the tree tops, traveling from tree to tree, and rarely, if ever, descending to the ground.

In this purely arboreal life it will be easily seen that the prehensile tail of those species which possess such an organ must be a great assistance to their owners in traveling from bough to bough, and thus from tree to tree. Considering,

however, that the species, like the titis, in which the tail is not prehensile, are equally as arboreal in habits as those with prehensile tails, it is quite clear that the latter type of organ can only be regarded as a kind of luxury. Indeed, the whole question as to the reason why some monkeys have long tails, others short tails, and others, again, no tails at all, is involved in great obscurity.

The headquarters of the American monkeys are the great forest regions of the Lower Amazon Valley, known as the Selvas; although they are also abundant in many other parts of Brazil, and likewise in the Orinoco Valley in Venezuela. All these animals are truly tropical and subtropical, although they extend to a longer distance on the south of the equator than they do on the north. To the northward, indeed, it appears that monkeys do not extend beyond the Tropic of Cancer in the southern half of Mexico; whereas in South America they are known to range as far as the Rio Grande do Sul, in latitude 30°.

In the vast forests of South America, monkeys make their presence known by their loud cries much more than in any other part of the world, unless, indeed, it be those parts of the Oriental region inhabited by the gibbons. The best description extant of the nocturnal noises of the American forests is that given by Humboldt. "After eleven o'clock," writes the great German traveler and philosopher, "such a noise began in the contiguous forest, that for the remainder of the night all sleep was impossible. The wild cries of the animals rang through the woods. Among the many voices that resounded together, the Indians could only recognize those which, after short pauses, were heard singly. There was the monotonous, plaintive cry of the aluates [howling monkeys], the whining, flute-like notes of the small sapajous, the grunting murmur of the striped night-monkey (*Nyctipithecus trivirgatus*), which I was the first to describe, the fitful roar of the great tiger [jaguar], the cuguar, or maneless American lion [puma], the peccary, the sloth, and a host of parrots, parraquas, and other pheasant-like birds. Whenever the tiger approached the edge of the forest, our dog, who before had barked incessantly, came howling to seek protection under the hammocks. Sometimes the cry of the tiger resounded from the branches of a tree, and was then always accompanied by the plaintive, piping tones of the monkeys, who were endeavoring to escape from the unwonted pursuit.

"If one asks the Indians why such a continuous noise is heard on certain nights, they answer, with a smile, that 'the animals are rejoicing in the beautiful moonlight, and celebrating the return of the full moon.' To me the scenes appeared rather to be owing to an accidental, long-continued, and gradually increasing conflict among the animals. Thus, for instance, the jaguar will pursue the peccaries and the tapirs, which, densely crowded together, burst through the barrier of tree-like shrubs which opposes their flight. Terrified at the confusion, the monkeys on the tops of the trees join their cries with those of the larger animals. This arouses the tribes of birds who build their nests in communities, and suddenly the whole animal world is in a state of commotion. Further experience taught us that it was by no means always the festival of moonlight that disturbed the stillness of the forest; for we observed that the voices were loudest during the violent storms of rain, or when the thunder echoed and the lightning flashed through the depths

of the woods. The good-natured Franciscan monk, who accompanied us, used to say, when apprehensive of a storm at night, 'May Heaven grant a quiet night both to us and to the wild beasts of the forest!'

In connection with this subject, we may mention that a subsequent traveler, the late Mr. Bates, when on the Tapajos River, writes: "I heard for the first, and almost the only time, the uproar of life at sunset, which Humboldt describes as having witnessed towards the source of the Orinoco, but which is unknown on the banks of the larger rivers. The noises of animals began just as the sun sank beneath the trees, after a sweltering afternoon, leaving the sky above of the intensest shade of blue. Two flocks of howling monkeys, one close to our canoe, the other about a furlong distant, filled the echoing forest with their dismal roaring."

We have already mentioned the circumstance that a European traveler on one occasion supped on roast baboon; and we may here call attention to the fact that in Humboldt's time monkey flesh formed a by no means inconsiderable portion of the food of the natives of certain parts of South America, at least on particular occasions. Humboldt tells us that when his party was traveling in Ecuador, and had arrived at Esmeraldas, they found a native festival in progress. And in the room where the feast was held, they observed numbers of large roasted monkeys (of what species we are not informed), blackened by smoke, and arranged round the walls. These monkeys were bent into a sitting posture, with the head generally resting on the long and skinny arms, and had been roasted by being placed on a grating of very hard wood over a clear fire. Humboldt observes that on seeing the natives devour an arm or leg of one of these roasted monkeys, it was difficult not to believe that this habit of eating animals so closely resembling man in their physical organization had, to a certain degree, contributed to diminish among these people the horror of cannibalism.

THE SAPAJOUS, OR CAPUCHIN MONKEYS

Genus *Cebus*

The long and prehensile tailed monkeys so commonly seen in menageries, and known respectively as sapajous or capuchin monkeys, and spider-monkeys, may be regarded as the typical representatives of the family *Cebidæ*; and, together with two other genera, constitute a group which can be easily recognized, and as easily distinguished from all their cousins. With the exception of the howlers, of which more anon, this group of monkeys is indeed the only one furnished with prehensile tails; and, altogether apart from the question of voice, and the presence of certain structures connected therewith, all its members differ from the howlers by their rounded heads and the nearly vertical plane of the face.

The sapajous may at once be distinguished from the other three genera included in this group by the circumstance that their tails, which are comparatively stout and of only moderate length, have no naked part on the lower surface of the extremity. In this respect they are not so perfectly adapted for the purpose of pre-

hension as are those of the other genera. Another feature of these monkeys is that the hair does not partake of a woolly nature. The general build of the body is rather stout; the arms and legs accord in this respect with the body, not being excessively long nor excessively slender.

The native name of these monkeys on the Amazon is Caiarara, or "macaw-headed," the word Arara meaning a macaw. It seems, however, that Caiarara is



THE WHITE-CHEEKED SAPAJOU (1), THE BROWN SAPAJOU (2), THE WHITE-THROATED SAPAJOU (3), THE SMOOTH-HEADED SAPAJOU (4).
(One-sixth natural size.)

abbreviated frequently into Cai, and from the latter it appears that the name Sajou or Sapajou has been evolved by a curious modification, originally due to the French naturalist, Buffon, using the word Sai (evidently the equivalent of Cai) for the weeper capuchin, and Sajou for another species of the genus. The term Capu-

chin doubtless takes its origin from the cowl-like appearance of the hair on the forehead.

The sapajous are represented by a large number of species, ranging from Central America to the south of Brazil. Our knowledge as to the real number of species is, however, still very incomplete, as there is a great amount of individual and racial variation, and the whole group requires to be carefully revised before anything definite can be said in regard to this point. We shall, therefore, allude only to some of the better-known kinds.

Like most of the South American monkeys, the sapajous go in troops, and in Brazil ascend to the very summits of the lofty forest trees. The late Mr. Bates mentions one which he shot at a height of fully one hundred and fifty feet above the ground. Writing of one of the Chilian species, M. Germain states that "these monkeys usually have a permanent sleeping-place, whence they issue every morning to explore the neighboring trees; the eggs and young of birds, insects, tender shoots, and, above all, fruits forming their chief food. I have never seen them," continues M. Germain, "on the ground, and I believe they never leave the tree-tops; while I have observed that they have particular routes in their journeys through the forest. The troops in which they live are not numerous, comprising from eight to a dozen individuals, under the leadership of an old and experienced male. When they arrive at the locality where the fruits of which they are in search are to be found, each endeavors to seize as speedily as possible the best upon which it can lay its hands; but, both on its arrival and during its return, the band is far from being in disorder. In dangerous places, where a kind of gymnastic performance has to be undertaken, the troop passes in single file, each one not risking the jump till the one in advance has safely passed, and then seizing firmly the same boughs and jumping in just the same manner as the latter. I have sometimes seen them at a height of about one hundred and fifty feet from the ground suspend themselves by the tail from a branch, then balance themselves, with all four limbs stretched out, then, all of a sudden, let themselves go, and falling for a distance of some twenty or thirty feet, seize hold of another bough by the tail. In such falls the outstretched arms seem only ready in case of accident, for there is never any question of maladroitness."

Together with the spider-monkeys, the sapajous are the most docile and the most readily taught of all the American monkeys, and since they bear confinement and the European climate well, they are the most common of the monkeys carried about by the peripatetic organ-grinder.

THE WHITE-CHEEKED SAPAJOU (*Cebus lunatus*)

The white-cheeked sapajou, of which a representation is given in the middle upper figure of the illustration on p. 149, is an inhabitant of Brazil. According to Dr. Gray's description, this animal is characterized by the length of the hair on the head, which is directed backwards, while that round the jaw is longer, and curved so as to form a kind of crest on each eyebrow. On the cheeks the hair is short and flattened down. The fur of the body and head is long, soft, and silky, its general

color being blackish, but that on the cheeks and temples is yellowish white. It is this light hair on the cheeks that gives its distinctive name to the species. The head is relatively large.

THE BROWN SAPAJOU (*Cebus fatuellus*)

In Guiana the sapajous are represented by a species commonly known as the brown sapajou, which presents a certain variation due either to differences of age,



THE HORNED SAPAJOU AND THE WEEPER SAPAJOU.
(One-sixth natural size.)

or to individual peculiarity, in regard to the form of the hair on the head, which has led to the supposition that there were two distinct species. In one of these forms, as represented in the upper right-hand figure of the cut on p. 149, the hair on the crown of the head is nearly flat, and directed backwards; this form having been described as *C. apella*. In the other variety, as shown in the left-hand figure of the accompanying engraving, the hair on the sides of the crown of the head is lengthened, so as to form a pair of more or less distinct longitudinal crests; this variety being hence known as the horned sapajou.

Although subject to great individual variation in this respect, the general color of the thick and rather harsh fur is reddish brown, becoming darker on the middle of the back, as well as on the legs and tail. The fore-arms, together with a broad spot on the crown of the head and the whiskers, are nearly or quite black; while the front of the shoulders is yellowish. It is on either side of the dark spot on the crown of the head that the crests are situated in the "horned" variety. The face and other naked parts have a violet tinge.

This sapajou has long been known to science, a specimen having been exhibited in the King's Menagerie at Paris soon after the middle of the last century, and described by the French naturalist Brisson. Another example, described by Frederic Cuvier, was exhibited in the same collection in the year 1820. It is in winter, when the fur is longest, that the crests of the "horned" variety become most prominent; these never making their appearance until the animal has cut its permanent canine teeth. Like that of its congeners, the disposition of this species in captivity is mild and affe

THE SLENDER SAPAJOU (*Cebus pallidus*)

The slender or white sapajou appears to be a rare local species allied to the preceding, and inhabiting Bolivia in the neighborhood of Santa Cruz. It is distinguished by the smaller size and lighter color of the dark spot on the crown of the head, which is generally brown, and often has a small crest on each side. The general color of the fur is fulvous, or grayish-fulvous, the limbs and tail being of a darker brown, and the beard a golden yellow. There is also a nearly white variety. Mr. Bates, who alludes to the slender sapajou as the Caiarara Branca, heard of its reported existence in the forests of the Tapajos River, which flows into the Amazon from the Cordillera Goral, on the Bolivian frontier of Brazil. His search was, however, in vain, and he was subsequently informed that the species only occurred across the watershed in Bolivia.

Another nearly related monkey, more widely spread in South America, is the tufted sapajou (*C. cirrifer*), in which the general color of the short fur is black, but yellowish-white on the cheeks, chin, sides of the forehead, and a narrow band over the eyebrows. Two long, recurved tufts of hair, which often occur on the side of the head, give the distinctive name to this monkey.

A monkey known to the natives of the Lower Amazon valley as the Macaca Prego is provisionally identified with this species by Mr. Bates, who speaks of it as frequenting the cultivated lands, where it commits wholesale depredations with the most unblushing effrontery. The worst of these thefts is that, from the hasty and random manner in which the fruit is broken and plucked, the creature wastes far more than it can eat. When about to return to its native forest, it carries away as much plunder as it can hold in its hands and under its arms.

THE WEEPER SAPAJOU (*Cebus capucinus*)

One of the best known and most common species of the genus is the weeper sapajou, or capuchin, of Brazil, represented in the right-hand figure on p. 151.

It is characterized by the hairs on the crown of the head being short and directed evenly backwards, without any tendency to form crests on the sides. The color of the fur is brown, with a golden tinge; the sides of the forehead, cheeks, throat, and chest, as well as the front of the shoulders, being pale yellow; while a black, or dark brown, line extends from the base of the nose to the back of the neck, gradually expanding as it goes backwards.

These sapajous have a wide range, extending right across Brazil, from Bahia in the east to Colombia in the northwest. With the exception of the occasions when they descend to drink, their whole life, according to Rengger, is spent in the trees of those regions of the forest where there is no underwood. They generally live in small parties, numbering from about six to ten or twelve individuals, of which the majority are females. From their shy and timid habits, they are very difficult to observe. Their cry appears to be limited to a kind of low whistle, which serves to attract attention to them. On one occasion the traveler mentioned above observed a party of these sapajous despoiling an orange tree of its fruit. They were led on by an old male, the females carrying their young on their shoulders. When all had reached the tree, some commenced to eat the luscious fruit as soon as plucked, while others carried off their share to the stronger boughs of the neighboring trees, in order to secure a better resting-place in which to devour their plunder at leisure. These seated themselves on such boughs, with their tails firmly curled round the same, and, placing the oranges between their hind legs, tried to open the skin with their fingers. If they did not quickly succeed in this, they flung the fruit against another bough in order by this means to soften the rind, at the same time venting their displeasure at this unnecessary trouble by snarls and growls. Probably on account of its bitter taste, none of them attempted to tear off the rind with their teeth, but, as soon as an opening was made with their fingers, they proceeded to tear out the juicy pulp, licking up the juice as it flowed out, and then eating the pulp itself. When satisfied with their repast, the elder members of the family stretched themselves along the boughs to sleep, while the juniors gamboled around, swinging themselves by their tails from the branches, or going up them hand-over-hand, like sailors up a rope. The gambols of these young ones are, however, described as being awkward and ungainly, instead of light and graceful. The mothers exhibited great care towards their young, carefully tending them, and assiduously dressing and searching their fur.

On another occasion the same traveler had the good fortune to witness a troop of these sapajous descending from the forest to pillage a maize field. They were seen to climb cautiously down from the trees, and venture by twos and threes into the maize field; and, having hastily gathered a few cobs, returned with all speed to the forest to devour them at leisure. On the appearance of the spectator of their movements, the whole of the members of the troop in the field promptly scampered back to the trees, not forgetting, however, to carry with them their booty. Rengger then shot a female carrying off a young one, which, though badly wounded, clung for some time by her tail to a bough. At length, however, she fell lifeless to the ground, with the young one still tightly clinging to her body, and, indeed, it was not until the body had become cold that the hold was released. The young capuchin

thus caught readily became tame, and would recognize its master even in the dark by the mere touch of his clothes. When wearied, it uttered a low whistling sound, and when it had occasion to demand any particular object, it groaned. Its anger was expressed in rough tones resembling the syllables "hu! hu!" fear by shrieks, and pleasure by soft chuckles.

When captured young, the capuchin is always easily tamed, but older animals refuse all food, become mopish, and do not live more than a few weeks. The younger ones soon take to their masters, and exhibit remarkable fidelity. They become, however, more readily attached to colored than to white people; and they are generally very fond of other animals, so that in Paraguay it is a common custom to bring them up with a young dog, upon which they ride. To some persons they at once conceive a rooted dislike, which cannot be eradicated. Their intelligence is shown by the manner in which they learn to open an egg; most of the contents being lost at the first trial, but carefully secured at the second attempt. Although they flourish in captivity if well attended to, great care must be taken to protect them from cold and damp. Their average term of life seems to be about fifteen years.

Like most other monkeys, captive capuchins are the very spirit of mischief, and are also prone to theft, more especially of eatables. When detected in the act of stealing, they will cry out before being touched; but if not caught, they pretend perfect innocence, going about as if nothing had happened. When disturbed, small substances are hidden by these creatures in their mouths, and consumed subsequently at leisure. They are extremely covetous, and this covetousness is taken advantage of to capture them. The negroes are in the habit of removing the pulp of a gourd through a small aperture, and then putting sugar inside; such a prepared gourd is then placed near the haunts of the capuchins, who come down and endeavor to extract the sugar, and during the process they suffer themselves to be caught.

THE WHITE-FRONTED SAPAJOU (*Cebus albifrons*)

The white-fronted sapajou is a common monkey in many parts of South America. It is allied to the last species, but is distinguished by its pale reddish-brown color, which becomes redder on the back and the outer surfaces of the limbs. The most characteristic coloration is, however, the white, which occupies the face, forehead, throat, shoulders, and chest.

Mr. Bates, who described this species as being of a light brown color, states that it is pretty generally distributed over the forest lands of the level parts of Brazil; and it was seen by this explorer in large flocks on the banks of the Upper Amazon. The members of such a flock are described as affording a wonderful sight when leaping from tree to tree; for, according to Mr. Bates, these monkeys (and we may presume their fellows of the same genus) are far-and-away the best performers in this gymnastic exercise. "The troops," observes Mr. Bates, "consist of thirty or more individuals, which travel in single file. When the foremost of the flock reaches the outermost branch of an unusually tall tree, he springs

forth into the air without a moment's hesitation, and alights on the dome of yielding foliage belonging to the neighboring tree, maybe fifty feet beneath ; all the rest following his example. They grasp, on falling, with hands and tail, right themselves in a moment, and then away they go along branch and bough to the next tree."

The same traveler, who had one of these monkeys as a pet, states that it kept the house in a perpetual uproar, screaming in a piteous manner when alarmed, excited, or hungry. It was always making a noise of some kind ; frequently screwing up its mouth and uttering a succession of loud whistling notes, resembling those mentioned by Rengger in his account of the preceding species. Frequently this young sapajou, when following its master, would walk upon its hind legs alone, although it had never been taught to do so. One day, however, in endeavoring to wrest some fruit from an owl-faced night monkey, it attacked the latter so fiercely that it cracked its skull with its teeth, upon which Mr. Bates considered that he had had enough of pet sapajous.

THE WHITE-THROATED SAPAJOU (*Cebus hypoleucus*)

This species, represented in the lower figure of the illustration on p. 149, is an inhabitant of Central America. It belongs to the same group as the preceding one, from which it is distinguished by its coloration. Thus, while the general color of the fur is black, the forehead and part of the crown of the head, as well as its sides, together with the throat and neck, are white ; while the naked portion of the face is of a pale flesh color.

THE SMOOTH-HEADED SAPAJOU (*Cebus monachus*)

The smooth-headed, monk, or yellow-headed sapajoti, is a species from Rio Janeiro and other places in Southeastern Brazil, which takes all three of its names from the extremely close and short yellow hair with which the front of the head is covered. It is represented in the left-hand upper figure of the illustration on p. 149.

The fur of this species is very short and stiff. In color, the crown of the head, the whiskers and chin, together with the shoulders, haunches, limbs, and tail, are pure black ; the sides and back, more especially in the hinder half of the body, are yellow, more or less mixed with black ; while the sides of the neck, the chest, and the front of the shoulders are yellow ; the forehead and temples being whitish yellow. Such is the striking coloration of the typical form of this species, but there are several variations therefrom, and the specimen represented in our illustration belongs to an olive-colored variety, which has been described as a distinct species, under the name of *C. olivaceus*.

THE CRESTED SAPAJOU (*Cebus robustus*)

The last member of this genus we shall notice is the crested sapajou of Brazil. This species is distinguished from all those previously mentioned by the long hair

on the crown of the head forming a single central crest of a more or less conical shape. The general color of the fur is bright red, with a black spot on the top of the crown, and the limbs and tail blackish.

THE WOOLLY MONKEYS

Genus *Lagothrix*

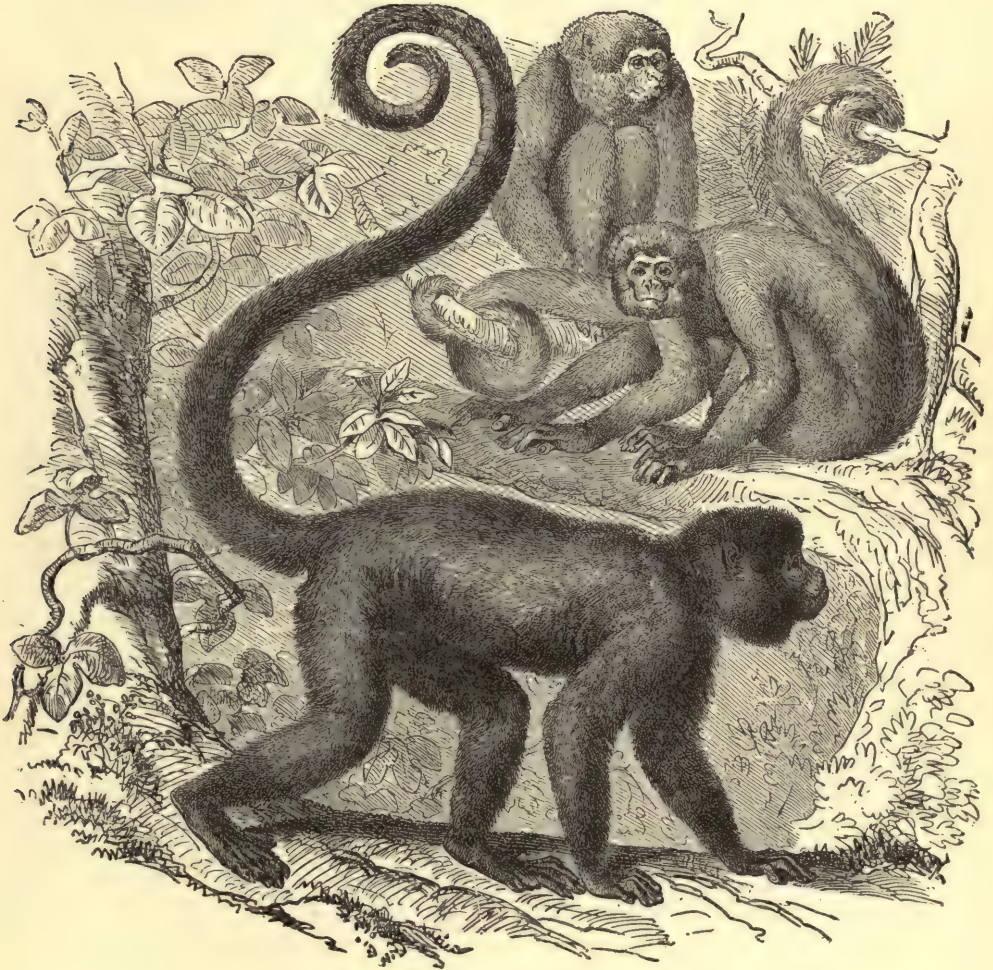
The woolly monkeys are best known by Humboldt's lagothrix (*Lagothrix humboldti*), first discovered by the traveler whose name it bears on the Orinoco, but also common in the upper part of the valley of the Amazon. This species, which is represented in our illustration, is the only one we shall describe, although three or four others are recognized by many zoologists.

The woolly monkeys take their name from the thick coat of woolly fur which is found beneath the longer hairs. This is one of the points by which they are distinguished from the sapajous. A more important point of difference is, however, to be found in the naked skin on the under part of the end of the tail—a characteristic in which these monkeys resemble those of the next two genera. The woolly monkeys have, however, the same robust build as the sapajous, and thereby differ from the other members of this group of genera. They have well-developed thumbs. The great length of the tail in the woolly monkeys, together with its naked tip, render it a prehensile organ of the most perfect type.

To the Portuguese colonists of Brazil these animals are known as Macaco Barrigudo, frequently abbreviated into Barrigudo; the full name signifying "big-bellied monkey," and being applied to them in allusion to their bulky build, as contrasted with the slender form of their cousins, the spider-monkeys. The ordinary form of Humboldt's lagothrix has a general blackish-gray color, with the head, chest, under parts, and tail, black. The individual hairs are dark gray, with very short black tips, on those parts of the body which are not black. Younger animals are more gray. Another form, which has been regarded as a distinct species by some zoologists, differs from the above variety in having gray fur on the head. Mr. Bates states that both these monkeys live together in the same places, and are probably only differently colored individuals of one and the same species. In one of the largest examples obtained by that traveler, the length of the head and body was twenty-seven and that of the tail twenty-six inches; these dimensions being exceeded among the American monkeys only by the black howler, whose head and body may measure thirty inches in length.

Mr. Bates observes that in Humboldt's lagothrix the skin of the face "is black and wrinkled, the forehead is low, with the eyebrows projecting; and, in short, the features altogether resemble, in a striking manner, those of an old negro. In the forests the barrigudo is not a very active animal; it lives exclusively on fruits, and is much persecuted by the Indians, on account of the excellence of its flesh as food. From information given me by a collector of birds and mammals, whom I employed, and who resided a long time among the Tucana Indians, near Tabatinga,

I calculated that one horde of this tribe, two hundred in number, destroyed twelve hundred of these monkeys annually for food. The species is very numerous in the forests of the higher lands, but, owing to long persecution, it is now seldom seen in the neighborhood of the larger villages. It is not found at all on the Lower Amazon. Its manners in captivity are grave, and its temper mild and confiding, like that of the coaitas [spider-monkeys]. Owing to these traits, the barrigudo is much



HUMBOLDT'S WOOLLY MONKEY.

(One-sixth natural size.)

sought after for pets; but it is not hardy like the coaitas, and seldom survives a passage down the river to Para."

From the account given by Mr. Bates as to the partiality displayed by the Indians of the Upper Amazon for this monkey as an article of food, it would seem that it is the one referred to in Humboldt's narrative of the roasted monkeys at Esmeraldas, quoted on p. 148.

THE WOOLLY SPIDER-MONKEYS

Genus *Eriodes*

The woolly spider-monkeys form a kind of connecting link between the woolly monkeys on the one hand, and the true spider-monkeys on the other; having the woolly under-fur of the former, but the slender build of the latter, while their thumbs are rudimentary. They differ, however, from both in that their nails are



THE WOOLLY SPIDER-MONKEY.
(One-sixth natural size.)

extremely compressed from side to side, and sharply pointed at the ends; while the partition between the nostrils is narrower.

Not much appears to be known of these monkeys, which have never been represented in the collection of the Zoological Society. They are confined to South-east Brazil, and have been divided into three species, mainly according to the degree of development of the thumb. The late Dr. Gray was, however, of opinion that

these are merely varieties of a single species (*Eriodes arachnoides*), since some individuals have a rudiment of a thumb on one hand and not a trace of one on the other. In the typical variety, as represented in our illustration, the general color is ashy brown, often tending to ferruginous at the base of the root of the tail, with the naked parts of the face flesh colored; the females being of a paler hue. The thumb is totally wanting. Another variety, with a distinct rudiment of a thumb, is of a dark brown color, with white on the sides of the face.

THE SPIDER-MONKEYS

Genus *Ateles*

The spider-monkeys may be regarded as those members of the group most admirably adapted for a purely arboreal life, as is especially shown by their slight bodies, the long prehensile tail, naked below at the end, and the long spider-like limbs from which they derive their popular title. In the rudimentary condition, or total absence, of their thumbs, the spider-monkeys may be regarded as holding the same relationship to the sapajous as is presented by the thumbless monkeys (*Colobus*) of Africa to the langurs (*Semnopithecus*) of India; and it is probable that in both instances the abortion of the thumb is due to the uselessness of this digit in a hand adapted to act merely as a kind of hook in swinging from branch to branch.

In general characteristics the true spider-monkeys agree with the woolly spider-monkeys, but are readily distinguished from them by the total absence of a woolly under-fur, the comparatively slight degree of compression in the nails, and the greater width of the partition between the nostrils; the thumb being generally absent. They are, moreover, of far more active habits, and in this respect are only equaled by the langurs and gibbons of the Old World, over which they have the advantage of the prehensile tail. To the description quoted from Waterton on p. 145, in which these monkeys are especially referred to, it may be added that they not unfrequently use this tail to convey fruit and other articles of food to their mouths. Those who have seen spider-monkeys swinging from rope to rope and leaping from side to side of their cages in menageries, can, when the cage is sufficiently large, gain some idea of their marvelous activity, although in such confined spaces their movements bear no comparison to what they are when in the boundless freedom of their native forests.

It is noteworthy that the stomachs of the spider-monkeys have a trace of the sacculated condition which distinguishes those of the long-limbed and long-tailed langurs and thumbless monkeys of the Old World. Their fur is generally smooth and stiff; and, as a rule, the hair on the crown of the head is directed forward.

The number of species of spider-monkeys is very large, and we shall thus be compelled to limit our notice to some of the better-known types. The genus has a wide geographical range, extending from Uruguay in the south to southern Mexico in the north.

THE RED-FACED SPIDER-MONKEY (*Ateles paniscus*)

The monkey represented in the figure on p. 144 is one of the best-known representatives of the genus, and is commonly termed the red-faced spider-monkey, although known to the natives of Brazil as the coaita. It is found over a large area of Brazil and Guiana, and, although exceeded in bulk by the woolly monkeys, is in absolute length of body the tallest of all the monkeys of these regions. It has



THE CHAMECK, OR THUMBED VARIETY OF THE RED-FACED SPIDER-MONKEY.

(One-fifth natural size.)

long been known to science, its scientific name having been given by Linnæus, while its native designation, coaita, was in use in Europe as far back as the time of Buffon. The coarse fur is black in color, and short on the crown of the head, although long and projecting on the forehead. The distinctive feature of the species is, however, the tawny flesh-colored hue of the prominent naked portions of the face, from which it derives its name.

In Brazil this species is found all over the lowlands of the valley of the Amazon, but it does not range to the southward beyond the limits of the river-plains, where it is replaced by the white-whiskered spider-monkey. Like the other species, it lives in small parties, and is comparatively silent. Its flesh is much esteemed by the natives of Brazil, who capture it alive by shooting it with arrows tipped with weak urari poison, and restoring it, when fallen, with salt.

On one occasion when out hunting these animals on the Lower Amazon, Mr. Bates remarks that his attention was first called to one of them by hearing a rustling in the boughs above. "There was something human-like in its appearance," he says, "as the lean, dark, shaggy creature moved deliberately among the branches at a great height. I fired, but unfortunately only wounded it in the belly. It fell with a crash, headlong, about twenty or thirty feet, and then caught a bough with its tail, which grasped it instantaneously, so that the animal remained suspended in mid-air. Before I could reload, it recovered itself, and mounted nimbly to the topmost branches, out of the reach of a fowling piece, where we could perceive the poor thing apparently probing its wound with its fingers. Coaitas are more frequently kept in a tame state than any other kind of monkey. The Indians are very fond of them as pets, and the women often suckle them when young at their breasts. They become attached to their masters and will sometimes follow them on the ground for considerable distances. I once saw a most ridiculously tame coaita. It was an old female, which accompanied its owner, a trader on the river, in all his voyages. By way of giving me a specimen of its intelligence and feeling, its master set to and rated it smartly, calling it scamp, heathen, thief, and so forth, all through the copious Portuguese vocabulary of vituperation. The poor monkey, quietly seated on the ground, seemed to be in sore trouble at this display of anger. It began by looking earnestly at him, then it whined, and lastly rocked its body to and fro with emotion, crying piteously, and passing its long, gaunt arms continually over its forehead; for this was its habit when excited, and the front of the head was worn quite bald in consequence. At length its master altered his tone. 'It's all a lie, my old woman; you're an angel, a flower, a good affectionate old creature,' and so forth. Immediately the poor monkey ceased its wailing, and soon after came over to where the old man sat." Mr. Bates adds that the disposition of these monkeys is mild in the extreme, having none of the painful, restless vivacity of their cousins the sapajous, and none of the surly and untamable temper of their more distant relatives, the howlers.

In the typical form of the red-faced spider-monkey, the thumb is absent. There is, however, a monkey similar to it in all respects, with the exception that it has a rudiment of the thumb on one or both hands. This monkey, which is known as the chameck, and is represented in the figure on the preceding page, has been regarded as a distinct species, under the name of *A. subpentadactylus*, but it seems preferable to consider it merely as a variety of the red-faced spider-monkey.

OTHER SPECIES

Black-Faced Spider-Monkey In Eastern Peru the place of the red-faced spider-monkey is taken by a closely allied species (*A. ater*), in which the face is of the same black tinge as the fur. From this feature the species derives its distinctive title of the black-faced spider-monkey. According to Dr. Gray, it is further distinguished from the red-faced species by the shorter hair on the forehead.

Hooded Spider-Monkey Passing by one or two species, such as the grizzled spider-monkey (*A. grisescens*), we come to a very well-marked form, known as the hooded, or black-capped spider-monkey (*A. cucullatus*), first described by Dr. Gray from a single example living in the London Zoological Society's Gardens, of which the exact habitat was unknown, although believed to be Colombia.

This species is distinguished by the length of the flaccid hair, which is of a mixture of black and silvery gray in color; and on the crown of the head is elongated, so as to form a large hood, or penthouse over the eyebrows. The fur of the hands, the feet, the crown of the head, and the nape of the neck, is deep black; while the naked parts of the face are flesh colored.

White-Whiskered Spider-Monkey The chuva, or white-whiskered spider-monkey (*A. marginatus*), has already been incidentally mentioned as found in the Lower Amazon valley, to the southward of the river plains which are inhabited by the red-faced species.

It is of nearly the same size as the red-faced spider-monkey; but has moderately long hair, of a uniform black color, with the exception of that on the forehead and the whiskers, which is white; the face being flesh colored. As in the last species, all trace of the thumbs has disappeared. It does not appear to be common, since Mr. Bates seems only to have come across one pair, both of which were shot, while specially searching for it in the valley of the Tapajos river. Being at the time unable to procure other animal food, this enterprising traveler was fain to try the flesh, and describes it as being the best-flavored meat he had ever tasted, although it was with difficulty that he persuaded himself to make the attempt.

Brown Spider-Monkey This species (*A. hybridus*) is a native of Colombia, and is of an ashy-gray color, sprinkled with black over the greater part of the body; the fur being very soft, with a tendency to curl, and mixed with a certain number of long and stiff blackish hairs. Other parts, however, such as the crown of the head, the fore-arms, the thighs, and the greater part of the tail, are black; the face being blackish, with white hairs on the lip. The inside of the thigh and upper arms are grayish. This monkey is but little known in Europe.

Black-Handed Spider-Monkey In Central America, northwards of the Isthmus of Darien, this group of monkeys is represented by *A. geoffroyi*, noticeable as being found at very high elevations. This species, which is also known as *A. melanochirus*, is the black-handed spider-monkey, readily recognized by the hands, feet, and the crown of the head being of a full black, while the fur of the

body is generally some shade of pale or reddish brown, although more rarely yellowish, or even yellowish white, and indeed extremely variable in coloration. It is commonly found on the volcanic mountain known as Orizaba, near Vera Cruz, in the south of Mexico, where it ranges up to an elevation of some two thousand feet, living in troops in the forests of the deep valleys. In the neighboring district of Oajaca it reaches, however, to a height of four thousand feet.

With the white-bellied spider-monkey (*A. belzebuth*) of Brazil we **White-Bellied Spider-Monkey** come to the first of a group of two or three species of spider-monkeys, distinguished from all those hitherto noticed by the under surface of the body and the inner sides of the lower legs and fore-arms being white or grayish-white. The present species is very variable in color, shading from black to reddish, with the loins paler, and the under parts and inside of the fore-arms, together with the front of the thighs, the inner surface of the legs, and the under side of the tail, whitish; the hair being rather long, and somewhat limp.

A Brazilian monkey, with rather longer hair and the under side of the tail black, has been described as a distinct species, under the name of the long-haired spider-monkey (*A. vellerosus*); but it may more probably be regarded as a well-marked variety of the species under consideration. These monkeys have been long known, and were described by Cuvier under the name of *Coaita à ventre blanc*. Besides inhabiting Brazil, they were met with by Humboldt on the Orinoco. They are stated to assemble in considerable troops.

THE VARIEGATED SPIDER-MONKEY (*Ateles variegatus*)

The last of the spider-monkeys we shall notice is the species represented in the figure on p. 164. It is remarkable for its brilliant coloration, and for its wide geographical distribution which extends from the upper reaches of the Amazon in Peru to the banks of the Rio Negro, flowing from Venezuela into the lower portion of the Amazon, and northwards into the Andes of Ecuador and Colombia. It was originally described by the German naturalist Wagner, from specimens obtained on the Rio Negro. Later on, however, Dr. Gray described a monkey, brought by Mr. Bartlett from the river Tigre, which flows from the north into the Amazon soon after it takes its great easterly bend on leaving Peru, as a new species, under the name of Bartlett's spider-monkey (*A. bartletti*). It proved, however, to be identical with the variegated spider-monkey of the Rio Negro.

The variegated spider-monkey is characterized by its thick, long, and soft hair. The general color of the fur is black, but the cheeks are white. There is a band of bright reddish yellow passing across the forehead a little distance above the eyes; while the under surface of the tail, the under parts of the body, and the inner surfaces of the limbs are yellow in the male and grayish white in the female. With the above variations in color it will readily be imagined that the male of this species is a striking animal. In addition to the more sombre tints of the female, the lines of separation between the colors are less marked.

On the river Tigre Mr. Bartlett describes these monkeys as living in small parties and traveling rapidly through the forests in the search of their favorite food, which is a berry resembling a gooseberry in size, but with a hard stone inside. Mr. Bartlett states that he had to ascend to the very summits of the ranges bordering the Tigre valley before his search was rewarded. "Here," he writes, "we came across a number of them — about eight or nine. I shot the male that is now in the



THE VARIEGATED SPIDER-MONKEY.
(One-sixth natural size.)

British Museum, and my Indians brought down another with a poisoned dart. Having obtained two of them I was satisfied that I had found a new species. While, however, I was busily preparing the first specimen, my Indians had quietly placed the other on the fire, and, to my great horror and disgust, they had singed the hair off, and thus spoilt the specimen. Of course I was obliged to keep the

peace, for they had not tasted meat for some days, and the monkey proved a very dainty dish."

The first example of this monkey brought alive to England came from the Upper Caura river in Venezuela, and arrived at the Gardens of the London Zoological Society on July 14th, 1870. Its stay there was, however, of the briefest, since it died on August 18th, following.

THE DOUROUCOULIS

Genus *Nyctipithecus*

The douroucoulis, or nocturnal owl-faced monkeys, belong to a group of three genera, distinguished from all the American monkeys hitherto noticed by their long tails not being prehensile. All of them have well-developed thumbs, and their general form is massive. They agree with the members of the preceding group in the upright profile of the face, and also in the circumstance that the front or incisor teeth of the lower jaw are placed vertically.

The douroucoulis, of which a party is represented in our illustration on p. 167, are distinguished from the other genera of the group by their rounded heads and the enormous size of their eyes. The latter are, indeed, so large that in the dried skull their sockets occupy almost its entire width, being separated from one another by a mere line of bone, considerably narrower than the opening of the nostrils. Another distinctive feature is the narrowness of the partition between the two nostrils, which is more like that of the monkeys of the Old World than of the other New World monkeys.

The ears are short, and the hair round the eyes is arranged in a radiating manner, after the fashion of the disc of feathers round the eyes of an owl. All the species are of relatively small size, and of purely nocturnal habits.

Apparently from the small size of their ears the traveler Humboldt gave them the name of earless monkeys (*Aotus*), but the name nocturnal monkey (*Nyctipithecus*) had been applied at an earlier date. We are unacquainted with the origin of the name douroucoulis.

According to Mr. Bates, they are known to the inhabitants of Ega, on the Upper Amazon, by the name of *E-ia*.

Writing of them at Ega, he says: "I found two species, closely related to each other, but nevertheless, quite distinct, as both inhabit the same forests, namely, those of the higher and drier lands, without mingling with each other or intercrossing. They sleep all day long in hollow trees, and come forth to prey on insects, and eat fruits only in the night. They are of small size, the body being about a foot long and the tail fourteen inches, and are thickly clothed with soft gray and brown fur, similar to that of a rabbit. Their physiognomy reminds one of the owl or tiger-cat. The face is round and encircled by a ruff of whitish hair; the muzzle is not at all prominent; the mouth and chin are small; the ears are

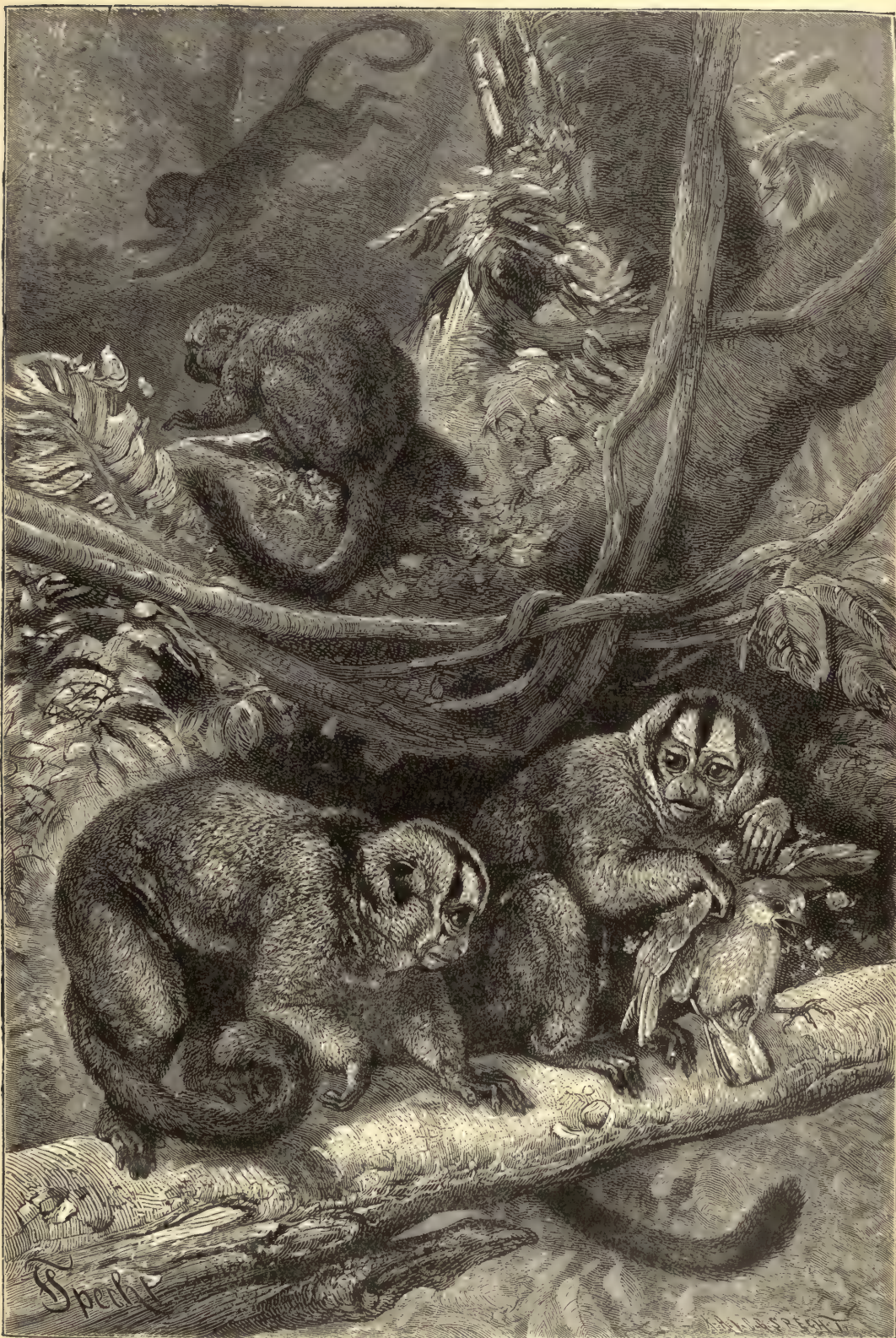
very short, scarcely appearing above the hair of the head; and the eyes are large and yellowish in color, imparting the staring expression of nocturnal animals of prey. The forehead is whitish, and decorated with three white stripes."

THE THREE-BANDED DOUROUCOULI (*Nyctipithecus trivirgatus*)

This species was first discovered by Humboldt on the banks of the river Cassiquiare, near the headwaters of the Rio Negro, in Venezuela; but it is likewise found in Guiana and Brazil. Its chief distinctive character is to be found in the circumstance that the three bands on the forehead continue distinct from one another on to the crown of the head. The fur is relatively short, and the tail cylindrical. The general color is a grayish brown, with a darker stripe down the middle of the back; the chest and under parts being ferruginous, and the tail blackish brown, except on the under part of its root, where it becomes yellowish.

The account given of this animal by Humboldt accords very closely with the descriptions of later naturalists. Humboldt refers to the difficulty of taming it, and states that one kept in his possession for nearly five months could not be reconciled to captivity. It slept during the day, concealing itself in the darkest corner it could find, and when awake could but seldom be induced to play with its master. Its agility in capturing flies was very remarkable. If irritated it hissed, and struck out with its paws after the manner of a cat, at the same time inflating its throat. Its voice, for so small an animal, was very powerful, and Humboldt compares its cry on some occasions to the roar of the jaguar, while at others it is described as a kind of mewling accompanied by a deep guttural sound.

Mr. Bates describes how he kept an individual of this species for many months when on the Amazon. He observes that "these monkeys, although sleeping by day, are aroused by the least noise; so that when a person passes by a tree in which a number of them are concealed, he is startled by the apparition of a number of little striped faces crowding a hole in the trunk. It was in this way that my companion discovered the colony from which the one given to me was taken. I was obliged to keep my pet chained up; it never became thoroughly familiar." After referring to an individual of the next species, Mr. Bates states that his douroucouli "was kept in a box, in which was placed a broad-mouthed glass jar; into this it would dive headforemost when anyone entered the room, turning round inside, and thrusting forth its inquisitive face an instant afterwards to stare at the intruder. It was very active at night, venting at frequent intervals a hoarse cry, like the suppressed barking of a dog, and scampering about the room, to the length of its tether, after spiders and cockroaches. In climbing between the box and the wall, it straddled the space, resting its hands on the palms and tips of the outstretched fingers, with the knuckles bent at an acute angle, and thus mounted to the top with the greatest facility. Although seeming to prefer insects, it ate all kinds of fruit, but would not touch raw or cooked meat, and was very seldom thirsty. I was told by persons who had kept these monkeys loose about the house that they cleared the chambers of bats as well as insect vermin. When approached gently, my E-ia allowed itself to be caressed; but when handled roughly, it always took



alarm, biting severely, striking out its little hands, and making a hissing noise like a cat." As is so frequently the case with small pets, this animal came to an untimely end, having been killed by the fierce attack of a sapajou monkey, as already related.

OTHER SPECIES

Feline Douroucouli The feline douroucouli (*N. vociferans*) takes its Latin name from the loud cry characteristic of all the monkeys of this genus. It is closely allied to the last species, from which it is distinguished by the circumstance that the three dark bands on the forehead meet on the top of the forehead itself, instead of continuing separately to the crown. It is an inhabitant of Brazil, dwelling in the same forests as the three-banded douroucouli, but always remaining separate.

Mr. Bates mentions that he once came across a perfectly tame individual of this douroucouli, belonging to the judge of Ega. It is described as being as lively and nimble as the sapajous, but far less mischievous, and more confiding in its disposition, delighting in being caressed by all visitors to the house of its owner, among whom it was a great favorite from the prettiness of its appearance, and its gentle ways. It was only, however, by great attention and kindness, continued for many weeks, that the owner of this little monkey had been able to make it so perfectly tame.

Broad-Tailed Douroucouli The broad-tailed, or lemurine douroucouli (*N. lemurinus*), derives its name from its broad and bushy tail, in which the hairs spread out on either side like those in the tail of a squirrel. It is further characterized by the greater length of the hair on the head and body, and also by the presence of a round pale-colored spot over each eye, separated by a broad dark median line; the three frontal bands of the first two species being wanting. This douroucouli is an inhabitant of Colombia, but we have not met with an account of its habits, which are, however, doubtless, much the same as those of the other species.

THE SQUIRREL-MONKEYS

Genus *Chrysothrix*

The pretty little squirrel-monkeys comprise a small group of species closely allied to the under-mentioned titis (under which name those of the group are often included), but distinguished by several important features. In the first place, the eyes are very large, approaching in this respect those of the douroucoulis, from which these monkeys are, however, distinguished by the wide partition between the nostrils, and the peculiar form of the head. The peculiarity in the shape of the head consists in its great elongation from front to back; the aperture by which the spinal cord passes out from the brain to the backbone being situated far in advance

of the hinder occipital region of the skull, which projects backwards behind the neck in a manner unknown in any other monkey. Other characteristic points are to be found in the relatively large size of the tusks or canine teeth, and also the comparatively short hair clothing the tail. The squirrel-monkeys, or saimir, as they were called by Buffon, also differ from the douroucoulis by their diurnal habits.



THE COMMON SQUIRREL-MONKEY.
(One-fourth natural size.)

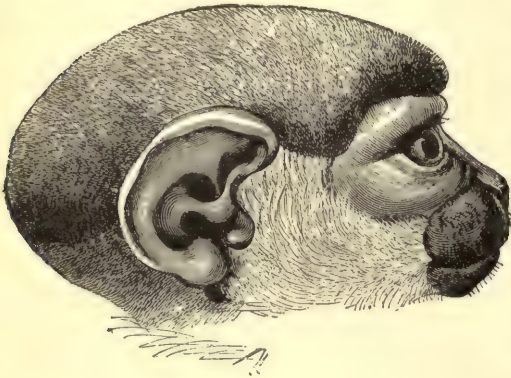
**Common
Squirrel-
Monkey**

The common squirrel-monkey (*C. sciurea*) is far the best-known representative of the genus; it is an inhabitant of Brazil and the valley of the Orinoco. It is a small animal, not much larger than a squirrel, with the head grizzled gray, tending to blackish, and the hairs of the fur of the body also gray, with a black mottling, but more or less tinged with gold in the region of the back. The outer sides of the fore-arms are yellowish, the paws whitish, and the long and slender tail tipped at the end with black.

Writing of this species, the traveler Humboldt observes that no other monkey has so much the physiognomy of a child; it exhibits a similar expression of innocence, a similar playful smile, and a similar sudden change from joy to sorrow, or *vice versâ*. When seized with fear its eyes are suddenly suffused with tears. The

one in possession of Humboldt was extremely fond of spiders and insects; and when shown uncolored figures of wasps, etc., in a work of Natural History, darted forward as if to seize the insect. It remained, however, perfectly indifferent to figures of heads and skeletons of Mammals.

When several of these monkeys confined in one cage were exposed to a shower of rain, they twined their tails round their necks, and huddled close together in order to impart to one another mutual warmth. The Indians of the Orinoco informed Humboldt that they often met with groups of ten or twelve of these monkeys thus cowering together, whilst others remained outside the group, uttering



SIDE VIEW OF THE HEAD OF THE SHORT-
TAILED SQUIRREL-MONKEY.

(From Sclater, *Proc. Zool. Soc.*, 1872.)

mournful cries at not being allowed to enter. By shooting poisoned arrows at such groups the natives are accustomed to obtain a number of young squirrel-monkeys at a time; the young clinging to their dying mothers as they fall, and, unless wounded, not leaving them even when dead. All the movements of these little monkeys are rapid, light, and graceful. They have a habit of steadfastly watching the mouth of a person when speaking; and if allowed to sit on the shoulder of their master, they will frequently touch his lips, tongue, or teeth. Mr. Bates speaks of the squirrel-monkeys in Brazil as living in

large flocks, and, when on the move, taking flying leaps from tree to tree.

This species (*C. usta*) is distinguished from the preceding one mainly by its shorter tail and naked ear. It inhabits the same regions as the last. In some specimens the outer side of the fore-arm is of the same color as the body, but in others it is shot with gold, as in the typical squirrel-monkey. A side view of the head is given in the accompanying figure.

In Bolivia the squirrel-monkeys are represented by a well-marked species (*C. entomophaga*), differing from both the above by its black head, and by the hairs of the body being yellow with long black tips.

These parti-colored hairs cause the general hue of the fur to be golden brown. The upper part of the body is, however, of the same black hue as the head; and this color likewise prevails on the tail, which is of moderate length. The face, throat, and the inner surfaces of the thighs are, on the contrary, of a yellowish-gray color.

THE TITI MONKEYS

Genus *Callithrix*

The titis, which form the last members of the present group of American monkeys, are distinguished from the squirrel-monkeys by their round and well-formed heads, which are not elongated posteriorly; by their smaller eyes, less developed canine teeth, and the much longer hair clothing the tail. They are chiefly inhabitants of Brazil and other parts of the Amazon valley, and are represented by some ten species, three of which have been exhibited alive in this country. We shall notice only some of the species.

Red Titi The red titi of Brazil (*C. cuprea*), which belongs to a group in which the fur is soft but intermingled with a number of long, stiff hairs, takes its name from the reddish-bay color of its hands, which forms a ready means of distinguishing it from the next species. The color of the upper parts is blackish mixed with gray, but the cheeks, throat, under parts, feet, and legs are of the same reddish-bay hue as the hands; the tail being generally rather darker than the back, although instances are known in which it has a white tip.

Collared Titi The second Brazilian species (*C. torquata*) is readily distinguished from the last by the white hair of the hands. In general color it is reddish brown tending to black, the hairs being red at the root and black at the tips. The face is surrounded by a narrow band of pure white hairs, and there is a narrow reddish-white collar round the neck, from which the species takes its name. The forehead, feet, and tail are quite black.

The remarkable coloration of this animal has obtained for it among the creoles of Brazil the name of the Widow Monkey; the white rim round the face, the whitish collar, and the white hands being compared to the veil, handkerchief, and gloves worn by widows in its native country.

By the natives of Brazil this and other titis are known by the name of Whaipusai. Although alluded to as the Moloch titi, it appears, judging by the reference to the long brown hair and the whitish hands, to be this species that was observed by Mr. Bates on the banks of the Tapajos river—the great southern tributary of the Lower Amazon. Be the species what it may, his description is the best that we have in English of the habits of the titis. He says that these animals have none of the restless vivacity of the sapajous and their allies, but are dull and listless; going in small parties of five or six individuals, and having the habit of running above the main branches of the forest trees. “One of the specimens which I obtained,” he observes, “was caught on a low fruit tree at the back of our house, at sunrise one morning. This was the only instance of a monkey being captured in such a position that I ever heard of. As the tree was isolated, the animal must have descended to the ground from the neighboring forest, and walked some distance to get at it. The species is sometimes kept in a tame state by the natives; it does not make a very amusing pet, and survives captivity only a short time.”

In Guiana this species is replaced by the closely allied white-chested titi (*C. amicta*), which is distinguished by the presence of a pure white spot on the chest; the general color being black, tinged with red.

Moloch Titi Another Brazilian species is the Moloch titi (*C. moloch*) which, while agreeing with those just noticed in the nature of the fur, differs in the color of the hands and feet, being of nearly the same gray hue as that of the back. The general color of the upper parts is dark gray, with a grizzle of black and red; the cheeks, chest, and under parts are reddish; and both the hands and feet dark gray.

The reed titi (*C. donacophila*) is a paler form, closely allied to the moloch. Mr. Bates states that while on the Lower Amazon, when going ashore early one morning, he found the forest resounding with the yelpings of a flock of whaiapusiai monkeys, which he thought probably belonged to this species. Although unsuccessful in obtaining a specimen, he was enabled to see them for a moment, and describes them as of small size, and clothed with long fur of a uniform gray color.

Black-Fronted Titi The black-fronted titi (*C. nigrifrons*), differs from any of those yet noticed by its rigid and bristly fur, and also by both the hands and feet being black. Its general color is gray, tinged with black; but it takes its name from the black forehead; the ears, a spot on each side of the neck, as well as the hands and feet, and the inner surfaces of the fore-arms and legs, being of the same sombre tint. The fur of the tail has a reddish tinge, while the back of the crown of the head and the nape of the neck are of a whitish gray.

The nearly related brown titi (*C. brunnea*), which is also known by the name of the masked titi, is subject to a great amount of individual variation in color.

Black-Handed Titi The last representative of these monkeys we shall notice is the black-handed titi (*C. melanochira*), which is one of two species which, while agreeing with the one last mentioned in its black hands and feet, is readily distinguished from the whole of those yet mentioned by the fur being soft and woolly, without any intermixture of long, stiff hairs. The general color of this titi is reddish, but the crown of the head, the throat, and the inner surfaces of the limbs, are a mixture of black and gray. There is a variety known in which the fur is bright red.

This species has been obtained from Bahia, on the eastern side of equatorial Brazil, but we have not come across any account of its habits, neither are we aware that it has ever been brought alive to Europe.

THE SAKI MONKEYS

With the Saki monkeys we come to a group containing only two genera, which, while resembling the douroucoulis and their allies in the nonprehensile character of their tails, are distinguished from them (and likewise from all other American monkeys) by the circumstance that all the front or incisor teeth of the lower jaw, instead of being vertical, are inclined forwards. In this respect these monkeys resemble the lemurs. Like the titis, they approximate to the howling monkeys by having the sides of the hinder part of the lower jaw considerably expanded.

Most of the sakis are characterized by having long hair on the crown of the head, which may either be divided in the middle line, or may radiate from the centre; and they all have whiskers and a beard, the latter being either broad and single or separated by a division in the middle, and inclining back on either side. While in some species, like Humboldt's saki, the long hair covers the head, body, and tail, in others this long hair is confined to the head, where it may be present on the crown, cheeks, and chin, or only on the two latter.



THE WHITE-HEADED SAKI.
(One-fourth natural size.)

The headquarters of the sakis appear to be Guiana and the valley of the Amazon, although they are also found in other districts. Mr. Bates speaks of them as being delicate animals, difficult to keep in captivity. They are described as being gentle and inoffensive in disposition when in confinement, but we know very little of their habits in the wild state, although it appears that they are normally silent.

THE WHITE-HEADED SAKI (*Pithecia leucocephala*)

The white-headed saki, of which we give a figure, is an inhabitant of Guiana, and may be regarded as the typical representative of the group. It is characterized by its white or yellowish forehead, marked by a central streak of black, the rest of the long fur being black, and the individual hairs of the same color throughout. In common with the two following species, the hair on the crown of the head is arranged in a radiated manner, the beard is broad and single, and the tail clothed with long hair, which, like that on the body, is stiff and coarse.

HUMBOLDT'S SAKI (*Pithecia monachus*)

In the Amazon valley, as far west as Ecuador, the white-headed saki is replaced by a species distinguished by having no black streak down the middle of the white or yellowish forehead, and also by the greater length of the hair covering the head and body. This species is Humboldt's saki, also known as the hairy saki (*P. hirsuta*), and, by the inhabitants of the Upper Amazon, as the parauacu. The general color is black with a gray grizzle, and the tip of each hair white. There is, however, a paler variety (*P. albicans*), in which the general color is grayish white, with only a large patch on the back, and the tail black; the individual hairs being tipped with pure white, as in the ordinary variety.

When at Ega, far up on the Amazon, and at no very great distance from the frontier of Ecuador, Mr. Bates saw several specimens of this monkey. He describes it as being "a timid, inoffensive creature, with a long bear-like coat of speckled gray hair. The long fur hangs over the head, half concealing the pleasing diminutive face, and clothes also the tail to the tip, which member is well developed, being eighteen inches in length, or longer than the body. The parauacu is found on the *terra firma* lands of the north shore of the Solimoens, from Tunantins to Peru. It exists also on the south side of the river, namely, on the banks of the Tefè, but there under a changed form, which differs a little from its type in colors." The variety here alluded to is the whitish one, which we have already mentioned. Mr. Bates goes on to say that this saki is "a very delicate species, rarely living many weeks in captivity; but any one who succeeds in keeping it alive for a month or two gains by it a most affectionate pet." Our author then proceeds to notice a specimen of the pale variety which belonged to a French inhabitant of Ega. This animal "became so tame in the course of a few weeks that it followed him about the streets like a dog. My friend was a tailor, and the little pet used to spend the greater part of the day seated on his shoulder, whilst he was at work on his board. It showed, nevertheless, a great dislike to strangers, and was not on good terms with any other member of my friend's household. I saw no monkey that showed so strong a personal attachment as this gentle, timid, silent little creature. The eager and passionate cebi (sapajous) seem to take the lead of all the South American monkeys in intelligence and docility, and the coaita (spider-monkey) has perhaps the most gentle and impressible disposition; but the parauacu,

although a dull, cheerless animal, excels all in this quality of capability of attachment to individuals of our own species. It is not wanting, however, in intelligence, as well as moral goodness, proof of which was furnished one day by an act of our little pet. My neighbor had quitted his house one morning without taking the parauacu with him, and the little creature having missed its friend, and concluded, as it seemed, that he would be sure to come to me, both being in the habit of paying me a daily visit together, came straight to my dwelling, taking a short cut over gardens, trees, and thickets, instead of going the roundabout way of the street. It had never done this before, and we knew the route it had taken only from a neigh-



HUMBOLDT'S SAKI.
(One-eighth natural size.)

bor having watched its movements. On arriving at my house, and not finding its master, it climbed to the top of my table, and sat with an air of quiet resignation waiting for him. Shortly afterwards my friend entered, and the gladdened pet then jumped to its usual perch on his shoulder."

It would appear that this interesting little creature did not long survive, as its skin was brought home by Mr. Bates, and is now preserved in the British Museum. If the life of these sakis is thus short when in comparatively free captivity in their native land, it must be doubly so when in our cold climate. We find this confirmed

by the record of the two which have been exhibited of late years in the London Zoological Gardens, one of which was received on the fifteenth of May, 1866, and died on the twenty-sixth of the following June.

The last representative of this group of sakis is the Brazilian whiskered saki (*P. rufiventer*), which is distinguished, among other features, by the hairs being marked by a yellowish ring near the end. It is also characterized in the adult state by the red color of the under parts, as well as by the forehead being of the same grayish-black color as the body. The moustache is yellow.

In the young of this species the moustache is white, while the under parts of the body are gray.

THE RED-BACKED SAKI (*Pithecia chiropotes*)

With the red-backed saki, which was first obtained by Humboldt on the banks of the Orinoco, and also occurs in Guiana, we come to the first of another group of the genus, distinguished in several points from all the species yet described.

In the first place, the hair of the head, although radiating from a central point, in the young, in the adult is divided by a median parting, and falls down on either side. Then the long beard is divided, by a gap in the middle of the chin, into two lateral moieties, while the fur on the body, instead of being long and harsh, is short and soft. The tail also has shorter hair than in the last group, and is thick and club-shaped. Finally, the hinder part of the lower jawbone is more expanded than in the typical group. The peculiar form of the neatly-divided and flattened hair of the head gives these animals the appearance of wearing a wig.

The general color of the fur in this saki is blackish brown, but there is a considerable area on the back and shoulders of a yellowish-red tint, from which the species derives its name. The tail is very thick and bushy, and the beard greatly developed.

Humboldt describes the red-backed saki as "a robust, active, fierce, and untamable animal; when irritated it raises itself on the hinder extremities, grinds its teeth, rubs the end of the beard violently, and darts upon the person who has excited its displeasure. In confinement, it is habitually melancholy, and is never excited to gaiety, except at the moment of receiving its favorite food. It seldom drinks, but when it does so the operation is performed in a peculiar manner. Thus, instead of putting its lips, after the manner of other monkeys, to the water or the vessel containing it, this species conveys it to its mouth in the hollow of the hand, at the same time bending forward its head. It is not, however, easy to witness this singular trait of character, since the animal is unwilling to satisfy its thirst when watched or likely to be observed." In their wild state the same traveler relates that these animals live only in pairs. Their voice, which is but seldom heard, is described as a kind of disagreeable grunt.

Closely allied to the preceding species is the one represented in the figure on the following page (*P. satanas*), which is an inhabitant of Brazil. It is readily distinguished by the absence of the yellowish red on the back

and shoulders; the whole of the fur being of a uniform blackish-brown color, generally tending to a more decided black in the male, and being browner in the female. In a male example in the Paris Museum, the back is brown and the wig black, while in a female both the back and the wig are more fulvous. Unusually black individuals were described by Dr. Gray as a distinct species, under the name of *Chiropotes ater*.

The black saki, or cuxio, as this species is termed in Brazil, appears to be restricted to the lower parts of the Amazon valley. It was observed by Mr. Bates



THE BLACK SAKI.
(One-fifth natural size.)

at Cameta, on the southern side of the Amazon delta, and is stated to dwell in the most retired parts of the forests, in regions where the ground is not subject to inundations. This naturalist was, however, unable to learn anything as to its habits in a wild state.

The last representative of these monkeys is the white-nosed saki (White-Nosed Saki (*P. albinasa*)), which is likewise an inhabitant of the dense forests of the valley of the Amazon. It is of a deep black color, with a paler tinge on the tips of the hair, except on the nose, which is pure white, and thus renders the animal easily recognizable.

THE UAKARI MONKEYS

Genus *Uacaria*

As we find among the monkeys of the Old World a great variation in regard to the relative length of the tail in closely allied forms, so in the New World there is a group of monkeys closely allied to the sakis, but distinguished by the extreme shortness of this appendage, and therein differing from all the other American monkeys. From their peculiar coloration, two of the uakaris, as these monkeys are called, are among the most remarkable mammals in the world.

All the three species of uakari have long and silky hair, which is directed forwards on the forehead; but they have scarcely any distinct beard. The tail is very short, never being more than about a third the length of the body, and sometimes being reduced to a mere stump. From the shortness of their tails, they received at first the very appropriate name *Brachyurus*; but since this term had been previously applied to another group of animals, it had to be changed, and Dr. Gray proposed the uncouth name *Uacaria*, as a Latinized form of their native title. The shelving forwards of the lower incisor teeth, which we have already noticed as characteristic of the sakis, is still more marked in the uakaris.

THE BALD UAKARI (*Uacaria calva*)

The species represented in our figure is one of two closely allied monkeys found in the valley of the Upper Amazon, and readily distinguished by their brilliant scarlet faces, and the light color of the long hair of their bodies. The length of the head and body of this species is about eighteen inches; the whole of the body, from the neck to the tail, being clothed with long, straight, and shining hair of a whitish color. The head is nearly bald, having only a very thin crop of short gray hairs. Beneath the chin and on the sides of the face there are bushy whiskers of a sandy color; while the tint of the eyes is reddish yellow. The contrast between these colors and the vivid scarlet of the naked part of the face must be very striking when the animal is alive; but, owing to the fugitive nature of the face-pigment, all this is lost in museum specimens.

This monkey has an extremely limited distribution, being found only on the left bank of the Amazon, in the neighborhood of Ega; its small area being limited to the east by the river Japura, and to the west by the Putumayo, or Ica, as it is often called. Mr. Bates states that in this area the uakari "lives in small troops amongst the crowns of the lofty trees, subsisting on fruits of various kinds. Hunters say it is pretty nimble in its motions, but is not much given to leaping, preferring to run up and down the larger boughs in traveling from tree to tree. The mother, as in the other species of the monkey order, carries her young on her back. Individuals are obtained alive by shooting them with the blow-pipe and arrows tipped with diluted urari poison. They run a considerable distance after being pierced, and it requires an experienced hunter to track them. He is considered the

most expert who can keep pace with a wounded one, and catch it in his arms when it falls exhausted. A pinch of salt, the antidote to the poison, is then put into its mouth, and the creature revives. The species is rare, even in the limited district which it inhabits.

“Adult uakaris, caught in the way described, very rarely become tame. They are peevish and sulky, resisting all attempts to coax them, and biting any one who ventures within reach. They have no particular cry, even when in their native woods; in captivity they are quite silent. In the course of a few days or weeks, if not carefully attended to, they fall into a listless condition, refuse food, and die.



THE BALD UAKARI.
(One-seventh natural size.)

Many of them succumb to a disease which I suppose, from the symptoms, to be inflammation of the chest or lungs. The one which I kept as a pet died of this disorder, after I had had it about three weeks. It lost its appetite in a very few days, although kept in an airy veranda; its coat, which was originally long, smooth, and glossy, became dingy and ragged, like that of the specimens seen in museums, and the bright scarlet color of its face changed to a duller hue. This color, in health, is spread over the features up to the roots of the hair on the forehead and temples, and down to the neck, including the flabby cheeks, which hang

down below the jaws. The animal in this condition looks, at a short distance, as though some one had laid a thick coat of red paint on its countenance. The death of my pet was slow; during the last twenty-four hours it lay prostrate, breathing quickly, its chest slowing heaving; the color of its face became gradually paler, but was still red when it expired. As the hue did not quite disappear until two or three hours after the animal was quite dead, I judged that it was not exclusively due to the blood, but partly to a pigment beneath the skin, which would probably retain its color a short time after the circulation had ceased.

"After seeing much of the morose disposition of the uakari," continues Mr. Bates, "I was not a little surprised one day at a friend's house to find an extremely lively and familiar individual of this species. It ran from an inner chamber straight towards me, after I had sat down on a chair, climbed my legs, and nestled in my lap, turning round and looking up with the usual monkey's grin, after it had made itself comfortable. It was a young animal, which had been taken when its mother was shot with a poisoned arrow; its teeth were incomplete, and the face was pale and mottled, the glowing scarlet hue not supervening in these animals before mature age; it had also a few long black hairs on the eyebrows and lips. The frisky little fellow had been reared in the house amongst the children, and allowed to run about freely, and take its meals with the rest of the household.

"The uakari is one of the many species of animals which are classified by the Brazilians as *mortal*, or of delicate constitution, in contradistinction to those which are *duro*, or hardy. A large proportion of the specimens sent from Ega die before arriving at Para, and scarcely one in a dozen succeeds in reaching Rio Janeiro alive. The difficulty it has of accommodating itself to changed conditions probably has some connection with the very limited range, or confined sphere of life, of the species in its natural state, its native home being an area of a swampy woods, not more than about sixty square miles in extent, although no permanent barrier exists to check its dispersal, except towards the south (where the Amazon flows), over a much wider space."

Mr. Bates then goes on to relate how he had a captive uakari on board his vessel, at the mouth of the Rio Negro, which escaped into the forest. On the day after its escape, however, it reappeared, and took up its accustomed position on the vessel, having evidently discovered that the forests of the Rio Negro were by no means so suited to its existence as those of the delta lands of its native Japura river. Uakaris are never known to descend of their own accord to the ground, the forests inhabited by them being inundated during the greater part of the year. Hence the shortness of their tails is no indication of their habits being more terrestrial than those of the long-tailed sakis.

OTHER SPECIES

Red-Faced Uakari

On the western side of the Putumayo river, the bald uakari is replaced by a closely allied species, known as the red-faced uakari (*U. rubicunda*), which appears to have an equally confined distributional area, although the exact western limits of its range are unknown. This uakari dif-

fers from the preceding by the hair of the body and the limbs being of an almost uniform rich, deep chestnut hue, only becoming rather paler on the neck. This is in marked contrast to the pale sandy white, tending slightly to rufous, on the under parts and the inner surfaces of the limbs, characteristic of the baldheaded uakari. Both species agree, however, in their brilliant scarlet faces, and in having hair of a rich chestnut tint beneath the throat; and there can be no doubt but that they are extremely closely related, and have acquired their slight differences of coloration by being now completely separated from one another, although descended at no very distinct epoch from a common ancestor.



THE BLACK-HEADED UAKARI.

Black-Headed Uakari The most northerly representative of these monkeys is the black-headed uakari (*U. melanocephala*), which is found in the forests to the north of the Rio Negro, especially on the Cassiquiare and the Rio Branco. It thus enters the basins of both the Amazon and the Orinoco, so that it has a considerably larger distributional area than either of the other species, from both of which it is widely different in coloration.

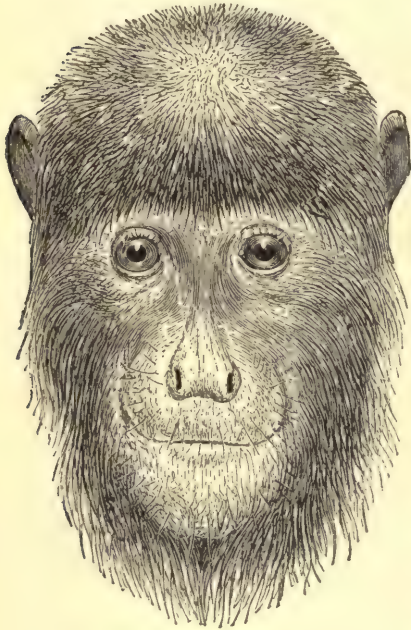
The general color is blackish, but the back and sides of the body are yellowish, while the loins, the outer surface of the thighs, and the tip of the tail are reddish chestnut; the face, hands, and feet being completely black.

THE HOWLING MONKEYS

Genus *Mycetes*

The howling monkeys, or howlers, derive their name from their vociferous cries, which are sufficient in the living condition to distinguish them from all the other American monkeys. To produce this extraordinary noise,—of which more anon,—there is a peculiar hollow shell of bone joining on to the upper part of the windpipe, corresponding to the so-called hyoid bone of man, which is a very small and solid structure. The resonance of the voice within this cavity communicates to

the cry its peculiar intensity. In order to provide space for this bony shell, the sides of the lower jawbone are extremely deep, and by this characteristic, as well as by the extreme flatness of the part containing the brain, the peculiar skull may always be recognized. A front view of the head of a howler is given in the accompanying cut, to illustrate the form of the nostrils in the American monkeys.



HEAD OF THE VERA CRUZ HOWLING
MONKEY.

(From Sclater, *Proc. Zool. Soc.*)

The howlers differ from the two preceding groups, and agree with the spider-monkeys and their allies, in having prehensile tails, of which the under surface of the extremity is naked. In addition to the presence of the large bony swelling at the top of the windpipe, they may be at once distinguished from all other prehensile-tailed monkeys by the extreme obliquity of the plane of the face and the projecting muzzle. This obliquity of the face is connected with the flattening of the hinder part of the skull, already referred to; and is so marked that the profile inclines backwards almost in a straight line from the muzzle to the crown. Like all American monkeys,

except the spider-monkeys and some of their allies, the howlers have well-developed thumbs. Their face is naked, with the muzzle very projecting; the naked parts being surrounded by a fringe of long hair on the forehead, cheeks, and chin. On the forehead this long hair may be directed either backwards or forwards, but that of the whiskers and beard always hangs down. The hair of the body, although shorter than that surrounding the face, is relatively long.

The howlers are especially abundant in Brazil, but they also range into Central America. They are represented by a considerable number of species, but since these are chiefly distinguished from one another by the color of their hair, and there is considerable individual and sexual variation in this respect, it is in some cases

difficult to decide as to which variations we ought to regard as indicating distinct species, and which merely as local races. The food of these monkeys is stated to consist entirely of leaves.

Humboldt says that, when traveling in the neighborhood of the Orinoco, the rising of the sun was always heralded by the cries of the howlers. Frequently this traveler and his companion, Bonpland, observed troops of them moving slowly in



THE BLACK HOWLER.
(One-fifth natural size.)

procession from tree to tree. A male was always followed by a number of females, several of the latter bearing their young on their shoulders. The uniformity with which they perform their movements is described as being very remarkable. According to the observations of Humboldt, as detailed by one of his biographers, whenever the branches of neighboring trees do not touch one another, the male, who heads the party, suspends himself by the naked prehensile part of his tail, and, let-

ting fall the rest of his body, swings himself till in one of his oscillations he reaches the neighboring branch. The whole file performs the same movements on the same spot. The Indians told the travelers that when these monkeys filled the forests with their howling there was always one that chanted, as leader of the chorus. During a long interval one solitary and strong voice was generally distinguished, till its place was taken by another of a different pitch.

Writing in relation to a specimen of one of these monkeys, brought to him when traveling on the Lower Amazon, Mr. Bates observes that "the howlers are the only kind of monkeys which the natives have not succeeded in taming. They are often caught, but they do not survive captivity many weeks. The one of which I am speaking (apparently a female of the black howler), was not quite full-grown. It measured sixteen inches in length, exclusive of the tail; the whole body was covered with long and shining dingy-white hair, the whiskers and beard only being of a tawny hue. It was kept in a house, together with a coaita and a caiarara monkey (*Cebus albifrons*). Both these lively members of the monkey order seemed rather to court attention, but the howler slunk away when any one approached it. When it first arrived, it occasionally made a gruff subdued howling noise early in the morning. The deep volume of sound in the voice of the howling monkeys, as is well known, is produced by a drum-shaped expansion of the larynx. It was curious to watch the animal while venting its hollow cavernous roar, and observe how small was the muscular exertion employed. When howlers are seen in the forest, there are generally three or four of them mounted on the topmost branches of a tree. It does not appear that their harrowing roar is emitted from sudden alarm; at least, it was not so in captive individuals. It is probable, however, that the noise serves to intimidate their enemies."

THE BLACK HOWLER (*Mycetes caraya*)

We select as our first example of that group of howlers in which the hair of the forehead is directed forwards so as to overhang the eyes, and the crown of the head is smooth, with radiating hairs, the black howler, either a young male or female of which is alluded to in the passage cited above.

It is a native of Brazil. The adult males have their fur mainly of a uniform black color, interspersed with red hairs on the flanks and loins. The females and young males are of a dingy white, and were described as belonging to a distinct species, under the name of *M. stramineus*. At one time there were young males of the black howler in the Jardin des Plantes, at Paris, which actually changed from the white into the black state. Mr. Bates's example was obtained on the Madeira river, the largest southern tributary of the Amazon.

The yellow-handed howler (*M. belzebul*) is another Brazilian representative of this group, which has been known since the time of Linnæus. It appears to vary considerably in color, so that one variety was described as a distinct species (*M. flavimanus*). According to the late Dr. Gray, the general color of the fur may be either uniform black or reddish, with some brown hairs on the shoulders; but the hands and feet, as well as a line running down the middle of the upper surface of

the tail, the tip of the same, together with a spot in front of each ear, and another on the knee, are invariably reddish yellow. Mr. Bates states that the variety which is reddish colored all over is the prevalent type of howler in Para, on the southern side of the delta of the Amazon; while in the island of Marajo, or Macajo, in the middle of the delta, this form is replaced by the darker one with yellowish hands and feet.

The red-and-yellow howler (*M. auratus*) is a third species from Brazil belonging to this group, in which the general color is dark chestnut brown, with the back and sides golden yellow, and the beard somewhat darker. Dr. Gray also applied distinct names to two other Brazilian howlers.

OTHER SPECIES

**Vera Cruz
Howler** As the black howler is the most southerly representative of the genus, so *M. villosus*, the Vera Cruz howler (of which the head is figured on p. 182) is its most northerly example. This species differs from the black howler by its long soft hairs, which near their bases show a rufescent tinge, in the hair of the face being inclined forwards, instead of reversed, and also in the color of the female and young being black, like that of the male.

Red Howler The red or golden howler (*M. seniculus*) is perhaps the best-known representative of the group in which the hair is bent back so as to form a ridge across the centre of the crown of the head. The general color is a reddish chestnut, but golden yellow in the middle of the back. It appears that in young individuals the hairs are short and stiff, without any under fur, and uniformly colored throughout their length. In older individuals, however, they become long, soft, and silky, and are brown at the roots, and golden or chestnut colored at their tips; while at the same time a thick under fur is developed. It was old individuals with this long silky kind of hair that Dr. Gray described as a distinct species, under the name of the silky howler (*M. laniger*).

This howler appears to be mainly a northern form, occurring in Colombia on the west, and in Guiana on the east side of South America; while, according to Mr. Bates, who describes its fur as being of a shining yellowish-red color, it is the sole representative of the howlers in the Upper Amazon valley. It also occurs in Ecuador; and, according to Dr. Gray, is represented by a pale variety in Bolivia.

The red howler is one of the two species of this genus that have been exhibited in the Gardens of the London Zoological Society. It is, however, difficult to keep alive for any length of time, and of two specimens received from the Dekka river, near Cartagena, on August 28th, 1863, the one died on September 25th, and the other on October 7th of the same year. Writing of these howlers, which he states are known to the natives as ouarines, and on the Demerara in Guiana are commonly known as red monkeys, the traveler Charles Waterton states "that nothing can sound more dreadful than the nocturnal howlings of this red monkey. Whilst lying in your hammock amid these gloomy and immeasurable wilds, you hear him howling at intervals from eleven o'clock at night till daybreak. You would suppose that half the wild beasts of the forest were collecting for the work of

carnage. Now it is the tremendous roar of the jaguar, as he springs upon his prey; now it changes to his terrible and deep-toned growlings, as he is pressed on all sides by superior force; and now you hear his last dying groan beneath a mortal wound. Some naturalists have supposed that these awful sounds, which you would fancy are those of enraged and dying wild beasts, proceed from a number of red monkeys howling in concert. One of them alone is capable of producing all these sounds; and the anatomists, on an inspection of his trachea (windpipe), will be fully satisfied that this is the case. When you look at him, as he is sitting on the branch of a tree, you will see a lump in his throat the size of a hen's egg. In dark and cloudy weather, and just before a shower of rain, this monkey will often howl in the daytime; and if you advance cautiously, and get under the high and tufted trees where he is sitting, you may have a capital opportunity of witnessing his wonderful powers of producing these dreadful and discordant sounds. Thus one single solitary monkey, in lieu of having others to sit down and listen to him, according to the report of travelers, has not even one attendant. Once I was fortunate enough to smuggle myself under the very tree, on the higher branches of which was perched a full-grown red monkey. I saw his huge mouth open; I saw the protuberance on his inflated throat; and I listened with extreme astonishment to sounds which might have had their origin in the infernal regions."

The brown howler (*M. ursinus*) is a Brazilian species, apparently
Brown Howler found only or chiefly south of the Amazon. Its usual color is a blackish brown, more or less washed with yellow; and some varieties are almost entirely yellow, this being most marked on the limbs and tail. The howler described as *M. fuscus*, of which specimens have been exhibited in the London Zoological Society's Gardens, is regarded by Dr. Gray merely as a variety of this species. It has been observed that the specimens of this monkey from the more northerly regions of Brazil are rufous or ferruginous in color, while the females and those from the more southern regions are brown or blackish brown. This species is very closely allied to the red howler.

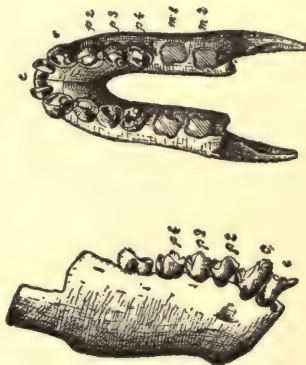
In Costa Rica, and probably also in other districts of Central
Mantled
Howler America, the howling monkeys are represented by a very well-marked species, known as the mantled howler (*M. palliatus*). This animal is characterized by the presence of a fringe of long brownish-yellow hair running along the lower part of the flanks, so as to form a kind of mantle on each side of the body. The general color of the fur is blackish brown, the hairs on the middle of the back, as well as on the upper parts of the sides, being yellowish brown, with black tips.

FOSSIL AMERICAN MONKEYS

In previous chapters we have seen how all the fossil monkeys of the Old World are more or less closely allied to the recent monkeys of that half of the globe, none of them showing any signs of closer affinity with their western cousins. The same holds good with regard to the extinct monkeys which have left their

remains in the great caverns of Brazil, or in the fresh-water superficial deposits which cover such large areas of country in Argentina and other parts of South America; all these belonging either to existing genera, and in some cases even species of American monkeys, or to extinct types of the same great family.

At the time when the huge ground-sloths known as megatheres and Mylodons roamed over the pampae of South America, the forests of Brazil re-echoed as now with the cries of howling monkeys, apparently identical with the species still living; while titis and sapajous are known to have existed at the same epoch, and remains of other living genera will doubtless also be found in the same deposits, which belong to what geologists term the Pleistocene period. At the same time, with these existing genera there also lived a totally extinct genus of monkeys, known by the name of *Protopithecus*. These monkeys appear to have been nearly related to the modern howlers, but were considerably larger than any living American monkey. In Argentina and Patagonia remains of monkeys, apparently belonging to this family, occur in much older strata, which have been correlated with the Eocene rocks of Europe. Marmosets are likewise represented in the superficial South American deposits.



UPPER AND SIDE VIEWS OF
LOWER JAW OF AMERICAN
TERTIARY MONKEY.
(*Homunculus*—After Ameghino.)

CHAPTER VI

APES, MONKEYS, AND LEMURS—*continued*

THE MARMOSETS

Family *HAPALIDÆ*

THE last, and at the same time the smallest, of all the true Primates are the tiny and beautiful little creatures popularly known as marmosets and tamarins. These elegant little animals, many of which are much smaller than a squirrel, are confined to South and Central America, and, although agreeing in many points with the American monkeys (*Cebidæ*), yet differ in so many others as to render it necessary to refer them to a distinct family.

The most important point by which the marmosets are distinguished from the American monkeys relates to their teeth. It will be remembered that the American monkeys are distinguished from all their Old World cousins by having thirty-six in place of thirty-two teeth; the increase being due to the presence of an additional bicuspid or premolar on either side of each jaw. Now, if we take the skull of a marmoset and count its teeth, we shall find that their number is the same as in the Old World monkeys, *viz.*, thirty-two. If, however, we carefully compare the cheek-teeth with those of an Old World monkey, we shall find that there is a very important point of difference. Thus, whereas in an Old World monkey, there are on each side of both the upper and the lower jaw two bicuspids or premolars (teeth which are preceded by milk-teeth) and three molars, we shall find that in our marmoset there are three premolars and only two molars. That is to say, in place of there being two cheek-teeth with a pair of cusps on the crown, which are preceded by milk-teeth, and three teeth with four cusps which are not so preceded, there are three of the former type and only two of the latter. Although, then, a marmoset agrees with an Old World monkey in the total number of its teeth, yet in the much more important character of the number of premolars it resembles an American monkey, from which it differs by the comparatively unimportant feature of the loss of the last molar in each jaw. A marmoset may, indeed, be defined as a small American monkey which has lost its wisdom teeth; and the dentition of these animals may be expressed by the formula $i \frac{2}{2}, c \frac{1}{1}, p \frac{3}{3}, m \frac{2}{2}$; total 32.

The next most important feature in which the marmosets differ from the true America monkeys is that, with the exception of the great toe, all their fingers and toes are furnished with pointed claws, instead of more or less flattened nails; this character, like the presence of the additional premolar tooth in each jaw, clearly

allying them to the lower types of Mammals. It is in this group, moreover, that we, for the first time, find the tail ringed with alternate dark and light bands; a feature occurring also in the lemurs and in some of the lower Mammals. As in the American monkeys, the thumb of the hand cannot be opposed to the fingers, neither are there naked callosities on the buttocks, nor are there pouches in the cheeks. None of the marmosets have prehensile tails. Their hind limbs are always consid-



MARMOSETS—(1) COMMON MARMOSET, (2) BLACK-TAILED MARMOSET,
(3) BLACK-EARED MARMOSET.
(One-fourth natural size.)

erably larger and more robust than the front ones, and the great toe is invariably of such small dimensions that, in a literal sense of the term, it has no sort of right to its name.

Many of the marmosets have the ears fringed with long pencils of hairs, which give them a very peculiar and unmistakable appearance. Both in size and habits

they are more like squirrels than monkeys, and they climb in the same way. They are, indeed, essentially arboreal animals, subsisting not only on fruits, but likewise, to a large extent, on insects. As we shall see later on, marmosets usually live in small parties, and all of them appear to be gentle in disposition, although frequently requiring a considerable amount of trouble and patience before they can be tamed. Whereas, other monkeys usually give birth to but a single young one at a time, marmosets normally have litters of two or three; and in this respect, therefore, show decided signs of their affinity with animals of inferior rank in the zoological scheme. They retain, however, the expressive and mobile faces characteristic of the higher monkeys.

There are a large number of kinds of marmosets, although there is still some uncertainty as to how many are entitled to rank as valid species. The whole of them are very similar in general appearance, but they may be conveniently divided into two genera, according as to whether the lower tusks or canine teeth are or not longer than the front teeth or incisors.

THE SHORT-TUSKED MARMOSETS

Genus *Hapale*

The marmosets of this group are characterized by the tusks not being longer than the incisors in the lower jaw, so that all the teeth present an even series. It is only in this genus that we meet with species in which the hair of the tail is marked by darker and lighter rings.

The common marmoset, or ouistiti (*H. Jacchus*), is one of the best and longest known members of the family, having been first described by Linnæus. It is an inhabitant of Brazil, more especially the south-eastern regions of that country, and belongs to a group in which the ears are large and bald over the greater part of their expanse, but furnished with a pencil of long hairs, which forms an expanded tuft on the front edge of their aperture; the hair on the sides of the crown of the head being likewise elongated. The tail is alternately ringed with bands of black and white, and the back has likewise darker and lighter cross bands.

The common marmoset, which is represented in the left figure of the illustration on p. 189, is of a generally blackish color, the back and outer surfaces of the thighs being marked with transverse bands of gray, and the head having a white spot on the upper part of the nose. The especial point of distinction is, however, that while the head is black and white, the tufts of hair on the ears are pure white.

The contrast between the black face and the white ear-tufts gives a very peculiar expression to this animal, reminding us somewhat of a white-haired negro. It is frequently brought to this country as a pet, and its behavior in captivity has been many times described.

The following account of the habits of a favorite ouistiti is given by a writer in London's *Magazine of Natural History* for the year 1829. This specimen was pro-

cured at Bahia, and at first it is described as being "exceedingly bold and fierce, screeching most vehemently when anyone dared to approach it. . . . It was long before it was so reconciled even to those who fed it as to allow the slightest liberty in the way of touching or patting its body; and it was almost impossible to do this by surprise, or by the most quiet and cautious approach, as the monkey was not steady a moment, but was constantly turning its head round from side to side, eying every person with the most suspicious and angry look. Its sense of hearing appeared to be excessively acute, so that the slightest whisper was sure to arouse it. The voice of this little animal was peculiarly sharp and disagreeable, consisting of a very quick succession of harsh and shrill sounds (imitated by the name ouistiti), so loud that they might be heard from the remotest part of the ship.

"For a considerable time there was no evident change in its habits, as it continued to be nearly as wild as when I first got it, and showed none of the playfulness and vivacity which characterize most of the monkey tribe. As long as the fruit which we had on board lasted, it would eat nothing else; but, when this failed, we soon discovered a most agreeable substitute, which it appeared to relish above everything. By chance we observed it devouring a large cockroach which it had caught running along the deck of the vessel; and from this time till nearly the end of the voyage,—a space of four or five weeks,—it fed almost exclusively on these insects, and contributed most effectually to rid the vessel of them. It frequently ate a score of the largest kind, which are two or two and a half inches long, and a very great number of the smaller ones, two or three times in the course of the day. It was quite amusing to see it at its meal. When it had got hold of one of the large cockroaches, it held the cockroach in its fore-paws, and then invariably nipped the head off first; it then pulled out the viscera and cast them aside, and devoured the rest of the body, rejecting the dry elytra and wings, and also the legs of the insect, which are covered with short, stiff bristles. The small cockroaches it ate without such fastidious nicety. In addition to these, we gave it milk, sugar, raisins, and crumbs of bread. Hitherto the weather was warm, the thermometer never being below 65° or 60° Fahr.; but as we reached a more northern latitude, and approached England, the change of temperature affected the monkey very considerably, and now it would not even touch the cockroaches when given to it; the hair, especially that on the tail, fell off; and, at the end of the voyage, this organ was almost quite bare and naked. It kept constantly in the kennel, rolling itself up in a piece of flannel, which had been put in for warmth, except when it could reach a sunny part of the deck, where it might bask in the heat. There was a considerable continuance of cold northeasterly winds, the thermometer ranging as low as from 42° to 36°, and as the monkey ate little or nothing, and was quite inactive, I hardly expected to have kept it alive.

"When I got it on shore I kept it for some days in a warm room; it gradually recovered its nimbleness, running about the room, and dragging its kennel after it. Even then it would not eat any insects, and its food consisted of milk and crumbs of bread; it was particularly fond of any sweet preserve, as jelly, and of ripe fresh fruits."

Mr. Bates, who compares the ouistiti to a kitten, banded with black and gray all over the body and tail, and having a fringe of long white hairs around the ears,

only observed this marmoset in the neighborhood of Para. On a certain occasion, he observed one of these animals comfortably seated on the shoulders of a mulatto girl, whom he met walking in Para; and, on inquiry, learned that it had been captured in the island of Marajo, at the mouth of the Amazon.

Another closely allied form from Brazil has been named the white-necked marmoset (*H. albicollis*), and is distinguished from the common form merely by the circumstance that the hinder part of the head and the back of the neck are gray instead of black.

In Southeastern Brazil there is yet a third nearly related form, **Black-Eared Marmoset** known as the black-eared marmoset (*H. penicillata*), of which a representation is given in the right-hand figures of the illustration on p. 189. The distinctive feature of this marmoset is to be found in the circumstance that, not only the whole of the head and neck, but likewise the tufts of long hairs on the ears, are completely black.

There are other varieties or species, differing somewhat from either of the above in the coloration of the head and ears.

White-Eared Marmoset The white-eared marmoset (*H. aurita*), which is likewise a Brazilian species, is the representative of a second group, in which the pencil of hairs on the ears is much more slender than in the common marmoset,

while the hair on the back is generally somewhat speckled, although faint traces of banding are occasionally observable. The tail is ringed like that of the common marmoset.

The general color of this marmoset is blackish, minutely speckled with yellow or a reddish tint on the back; the sides of the head, the limbs, and the hinder part of the body being pure black, while the crown of the head is brown, and a spot on the forehead, as well as the tufts on the ears, are gray. In some instances, where the back is more decidedly red than usual, there are faint, paler cross-bands in this region, and more especially on the loins.

The white-shouldered marmoset (*H. humeralifer*) is a closely allied Brazilian form, distinguished by the face, shoulders, chest, and

arms, as well as the tufts on the ears, being white; the thighs being a mixture of brown and white in color.



THE SILVER MARMOSET.

**Silver
Marmoset**

With the silver marmoset of Brazil (*H. chrysoleucus*) we come to the first of three species, distinguished from those yet noticed either by the absence of rings of color on the tail, or by the arrangement or absence of the longer hairs on the ears. They are all tiny little creatures, not much larger than a rat, and have no bands of color on the back.

The silver marmoset has large and nearly naked ears, covered on both sides near the margin with long hairs, forming a double fringe instead of a pencil. The fur of this elegant little creature is soft and silky, and either pure white or yellowish white in color. In the white variety the limbs and tail are, however, invariably yellowish; while in the variety in which the fur of the body is yellowish, that covering the limbs, tail, and under parts may be chestnut brown. These two varieties were regarded by Dr. Gray as distinct species, but this is not generally admitted by other writers.

**Black-Tailed
Marmoset**

This species (*H. melanura*) is readily distinguished from the preceding by the absence of the fringe of hairs on the large and flesh-colored ears, and likewise by the black tail. Usually the general color of the fur is ashy brown, paler on the front of the body, and whitish on the front of the thighs and loins; while the head and limbs are dark brown. There is, however, a variety which is entirely white, with the exception of the characteristic black tail. It is represented in the top figure of the illustration on p. 189.

Of this species, which he mentions under the name of *Midas argentatus*, Mr. Bates writes that it is one of the rarest of the American marmosets. "Indeed," says this writer, "I have not heard of its being found anywhere except near Cameta, where I once saw three individuals, looking like so many white kittens, running along a branch in a cacao grove; in their motions they precisely resembled the *M. ursulus*," of which a description is given later on. "I saw afterwards a pet animal of this species, and heard that there were many so kept and that they were esteemed as great treasures. The one mentioned was full-grown, although it measured only seven inches in length of body. It was covered with long, white, silky hairs; the tail being blackish and the face flesh colored. It was a most timid and sensitive little thing. The woman who owned it carried it constantly in her bosom, and no money would induce her to part with her pet. She called it Mico (the native name of these animals). It fed from her mouth, and allowed her to fondle it freely, but the nervous little creature would not permit strangers to touch it. If any one attempted to do so, it shrank back, the whole body trembling with fear, and its teeth chattered, whilst it uttered its tremulous, frightened tones. The expression of its features was like that of its more robust brother, *M. ursulus*; the eyes, which were black, were full of curiosity, and mistrust, and were always kept fixed on the person who attempted to advance towards it."

**Pigmy
Marmoset**

The third and last of the three diminutive species constituting this group is the pigmy marmoset (*H. pygmæa*), which is likewise found in the primeval forest regions of Brazil. This species is distinguished by the smallness of its short ears, which, although slightly hairy on their outer surface, have no tuft or fringe of long hairs, and are entirely concealed beneath the backwardly-directed and elongated fur of the crown of the head. A further distinc-

tion is to be found in the presence of darker and lighter rings on the tail. The general color of the body is a tawny or ferruginous brown, more or less varied with black and red on the back; the neck, under parts, and inner surfaces of the limbs being yellowish, and the hands and feet yellowish brown.

Three specimens of the pigmy marmoset were obtained by Mr. Bates on the upper Amazon, at San Paulo, near Ega. They are described as measuring only seven inches in length, exclusive of the tail. The tiny little face is furnished with long brown whiskers, brushed back over the ears; the general color of the body being brownish tawny, but the tail elegantly ringed with black. Mr. Bates adds that this marmoset ranges as far north as Mexico, and is the only Amazonian primate that wanders far from the great river plain. The silky marmoset has, however, also been recorded from Mexico.



THE PINCHÉ.
(One-sixth natural size.)

THE LONG-TUSKED MARMOSETS, OR TAMARINS

Genus *Midas*

The marmosets of this group are at once distinguished from those of the preceding genus by the circumstance that the tusks, or canine teeth, of the lower jaw are considerably longer than the front, or incisor teeth; so that the whole series of lower teeth does not present the even and regular height characteristic of the short-tusked marmosets. Why Buffon applied the name tamarin to one member of this group, we are unaware; but it has been subsequently very generally adopted for two of the species, and is a short and convenient name by which to designate the entire genus. None of the tamarins have penciled ears; neither, as we have already mentioned, have they ringed tails, although some of the species have the back marked with dark and light cross-bands.

THE NEGRO TAMARIN (*Midas ursulus*)

One of the best known of all the species is the common or negro tamarin, which is found in Guiana and the lower part of the Amazon valley. It belongs to a group in which both the forehead and face are hairy, and the hair of the head not longer than that of the body; the ears being large and naked. The color is a nearly uniform black, especially on the nose, lips, and hands; but the hinder part of the body has the fur more or less mottled with grayish white. Although not known as a distinct species at the time of Linnæus, this marmoset was described by the early French naturalists, and distinguished by Buffon as the *Tamarin nègre*.

Mr. Bates writes that the negro tamarin "is never seen in large flocks, three or four being the greatest number observed together. It seems to be less afraid of the neighborhood of man than are other monkeys. I sometimes saw it in the woods which border the suburban streets [of Para], and once I espied two individuals in a thicket behind the English consul's house at Nazareth. Its mode of progression along the main boughs of the lofty trees is like that of the squirrel; it does not ascend to the slender branches, or take the wonderful flying leaps which the *Cebidæ* do, whose prehensile tails and flexible hands fit them for such headlong traveling. It confines itself to the larger boughs and trunks of trees, the long nails being of great assistance to the creature, enabling it to cling securely to the bark; and it is often seen passing rapidly round the perpendicular cylindrical trunks. It is a quick, timid, restless, little creature, and has a great share of curiosity, for when a person passes by under the trees along which a flock is running, they all stop for a few moments to have a stare at the intruder. In Para, *M. ursulus* is often seen in a tame state in the houses of the inhabitants. When full-grown it is about nine inches long, independently of the tail, which measures fifteen inches. The fur is thick, and black in color, with the exception of a reddish-brown streak down the middle of the back. When first taken, or when kept tied up, it is very timid and irritable. It will not allow itself to be approached, but keeps retreating backwards when anyone attempts to coax it. It is always in a querulous humor, uttering a twittering, complaining noise; its dark, watchful eyes, expressive of distrust, observant of every movement which takes place near it. When treated kindly, however, as it generally is in the houses of the natives, it becomes very tame and familiar. I once saw one as playful as a kitten, running about the house after the negro children, who fondled it to their hearts' content. It acted somewhat differently towards strangers, and seemed not to see them seated in the hammock which was slung in the room, leaping up, trying to bite, and otherwise annoying them. It is generally fed on sweet fruits, such as the banana; but it is also fond of insects, especially soft-bodied spiders and grasshoppers, which it will snap up with eagerness, when within reach. The expression of countenance in these small monkeys is intelligent and pleasing. This is partly due to the small facial angle, which is given as 60° ; but the quick movements of the head, and the way they have of inclining it to one side when their curiosity is excited, contribute very much to give them a knowing expression."

ALLIED SPECIES

Red Handed Tamarin This species (*M. rufimanus*), which is the true tamarin of Buffon, is an inhabitant of Dutch Guiana, or Surinam, and differs from the preceding by its yellowish or orange-red hands ; its habits being, doubtless, precisely similar. Like the negro tamarin, it has been exhibited alive in England.

Brown-Headed Tamarin The brown-headed tamarin (*M. flavifrons*) is the Brazilian representative of several species or varieties distinguished from the two preceding forms by the face being brownish, with a few gray hairs, although the nose still remains black. The general color is black, with a white mottling on the hinder part of the back ; the head being pale brown, with some black markings. In the male the outer surface of the limbs generally has a bright rufous tinge, while the under parts and the inner surfaces of the limbs are reddish brown. The so-called black-and-red tamarin (*M. rufoniger*) would appear to be only a brighter-colored variety of this species, in which the back, loins, thighs, and legs are of a bright chestnut red. It occurs in Brazil, and appears to have been met with by Mr. Bates on the upper Amazon in the neighborhood of Ega. In referring to the marmoset, provisionally identified with this form, this traveler writes as follows : "One day, whilst walking along a forest pathway, I saw one of these lively little fellows miss his grasp as he was passing from one tree to another along with his troop. He fell headforemost from a height of at least fifty feet, but managed cleverly to alight on his feet in the pathway ; quickly turning round, he gave me a good stare for a few moments, and then bounded off gaily to climb another tree." Mr. Bates adds that the habits of this animal are precisely the same as those of the negro tamarin.

Deville's tamarin (*M. devillei*), from Peru, is another nearly related species, with the head, neck, front of the back, fore-limbs, and tail black ; the hinder part of the back marked with gray and black transverse bars ; and the loins and legs bright chestnut red.

Moustached Tamarin This curious little creature (*M. mystax*) belongs to a well-marked group of two or three species readily recognized by having the tip of the nose and the lips covered with white hairs, giving a very peculiar look to the face. It is found in the upper Amazon valley, both in Brazil and Peru. It is black, with a brownish tinge on the back and thighs ; the white hairs on the nose and lips being long, and forming a broad tuft. Mr. Bates, who met with this species on the upper Brazilian Amazon, near Tabatinga, says that, when seen from a short distance, it looks exactly as though it were holding ball a of snow-white cotton in its teeth.

The red-bellied tamarin (*M. labiatus*) is an allied upper Amazonian species, with a very smooth and glossy coat, of a deep blackish-brown color on the back ; while the under parts are a mixture of rich black and reddish hues. The white hairs on the nose and lips are much shorter and less conspicuous than in the moustached tamarin ; those on their lips merely forming a thin line on the margins, instead of a distinct tuft.

THE PINCHÉ (*Midas edipus*)

In Colombia (New Granada) and Panama, the tusked marmosets are represented by two closely allied species differing in certain points from all the species found in the more southerly or easterly regions. Both have the face and sides of the head but sparsely haired, while there is a distinctly marked patch of hair different from the rest on the crown of the head, and the hair on the neck is elongated.

The present species is restricted to Colombia, and has been long known in Europe; it received its name of Pinché—on what grounds we know not—from the French naturalist Buffon. It is represented in our illustration on p. 194, and is of a grayish-brown color on the back; the outer surface of the limbs and the root of the tail being tinged with red, while the long tuft of hair which forms a crest on the top of the head, as well as the throat, under parts, arms, and the front of the legs, are white; the tip of the tail being black.

Geoffroy's marmoset (*M. geoffroyi*), which is the representative of the Pinché in Panama, is distinguished from that species by the hair on the crown of the head not being elongated into a crest, but being short, and forming a narrow patch of an oblong shape. Its coloration is very nearly the same as that of the Pinché, with the exception that the hair on the nape of the neck is chestnut colored.

THE SILKY MARMOSET (*Midas rosalia*)

The last group of the marmosets is represented by the well-known silky marmoset, shown in the figure on the following page, and the golden-headed marmoset; both of which inhabit the forests of Southeastern Brazil, and are commonly exhibited in the menageries of Europe. They are distinguished by having the head and part of the neck covered with long hair, forming a kind of mane; the hair round the face being directed backwards. The face itself is but sparsely haired, and the naked ears are partly concealed by the mane. The color is a bright golden yellow, more or less tinged with red; but there is a variety in which the head, hands, and feet, as well as the end of the tail are blackish.

The silky marmoset was known to Buffon under the name of the Marikina; and has also been described as the lion marmoset (*M. leoninus*). Mr. Bates, who alludes to it under the latter name, which is due to the long mane of brown hair hanging from the neck giving it very much the appearance of a miniature lion, states that he once saw a tame individual of this species when on the upper Amazon. After commenting on its playful and intelligent disposition, he observes that it was familiar with every person in the house where it was kept, and seemed to take particular pleasure in climbing about the bodies of the various visitors who entered. "The first time I went in," writes Mr. Bates, "it ran across the room straightway to the chair on which I had sat down, and climbed up to my shoulder; arrived there, it turned round and looked in my face, showing its little teeth, and chattering, as though it would say, 'Well, and how do you do?'" It showed more affection towards its master than towards strangers, and would climb up to his head a dozen times in the course of an hour." These marmosets

are described as keeping to the very top of their cages—a habit probably retained from the native one of living in the tree tops. When descending they always come down backwards, with the tail pendent. Mr. Swainson, who observed these animals in their native Brazilian forests, states that their ways are very similar to those of the common marmoset. He mentions, however, their habit of bounding from tree to tree with incredible rapidity, which is scarcely consonant with the



SILKY MARMOSETS.
(One-fourth natural size.)

account given by Mr. Bates of the movements of marmosets in general. They are stated to utter sharp but weak cries of alarm when frightened.

The total length of this marmoset is rather less than two feet, of which one is occupied by the long tail.

The golden-headed marmoset (*M. chrysomelas*) may be regarded as a black representative of the preceding species; its general color being black, with the face, fore-arms, hands, feet, and the base of the tail tawny.

CHAPTER VII

APES, MONKEYS, AND LEMURS—*continued*

THE LEMURS

Family *LEMURIDÆ*

The whole of the animals treated of in the four preceding chapters, as possessing many characteristics in common, to which we have alluded in the course of our description, are regarded by zoologists as collectively constituting one great group of the order Primates. And since this group is also taken in zoological classification to include man himself, it is spoken of as the Anthropoid or Human-like group; the individual members thereof being referred to as Anthropoids.

We now come to another and lower group of animals, which, while sufficiently nearly allied to the above to be included in the order Primates, are so different as to be entitled to stand as a group of equivalent rank. These animals are primarily represented by the lemurs. The group also includes two other creatures which cannot be classed in the same family as the lemurs, and of which we shall treat in the succeeding chapter. As it is desirable to have a common name for all the members of this group, and as it would be incorrect to allude to the whole of them as lemurs, the term Lemur-like creatures, or, shortly, Lemuroids, has been proposed, and will be found convenient.

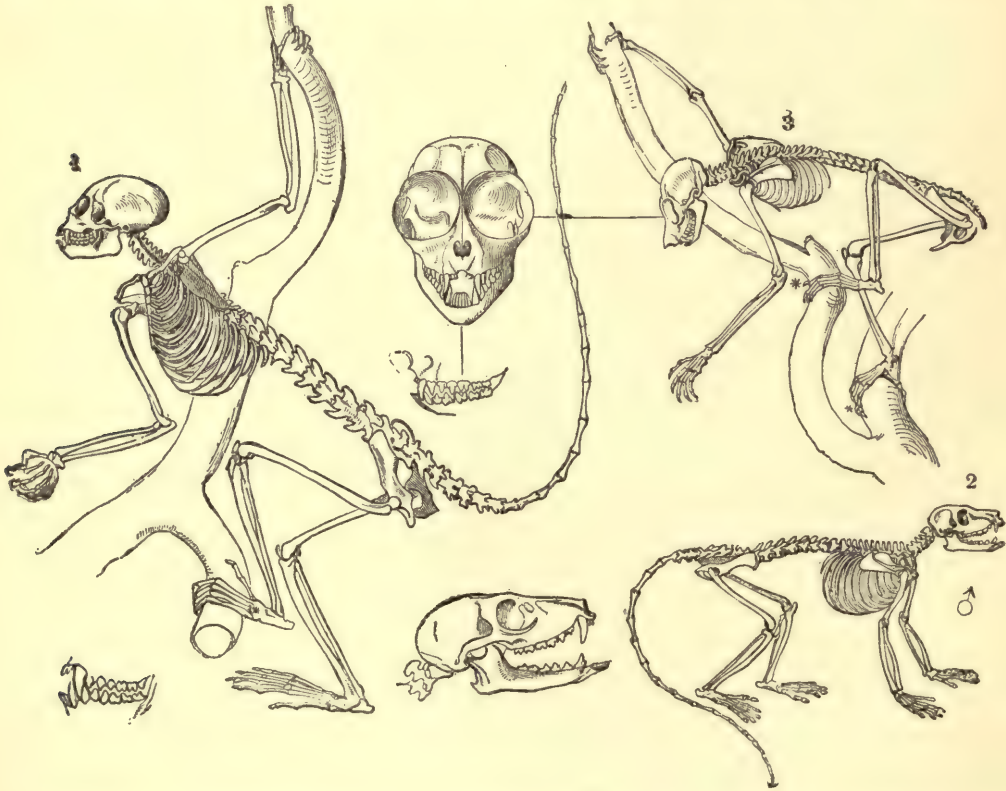
Although these Lemuroids may always be distinguished at a glance from the apes and monkeys by their foxy, expressionless faces, it is difficult to point out the important structural features by which they differ from the former without entering into anatomical details unsuited to a popular work like the present. The reader must, therefore, take it on trust that there are such important differences between the Anthropoids and the Lemuroids. In spite, however, of these differences, there are such resemblances between the two groups as to suggest that the lemurs and their allies are not far removed from the group from which we may presume (if the doctrine of evolution be the true key to the book of nature) the apes and monkeys to have originated.

Characteristics That the lemurs are much lower in the zoological scale than the apes and monkeys is shown by the simpler structure of their brains, which have far fewer foldings on their surface than is the case with those of the latter; the amount of such foldings, as giving a larger extent of superficial surface, being indicative of the mental powers of the owners of the brains.

A peculiar feature of all the lemurs and their allies is to be found in the circumstance that the second toe of the foot (corresponding to the index finger of the

hand) is always furnished with a sharp claw. All lemurs have a well-developed thumb and great toe; but, curiously enough, in some of them the index finger of the hand is rudimentary. They may or may not have tails, but these are never prehensile, although, as in some of the marmosets, they may be marked by alternate dark and light rings.

A point of resemblance to the monkeys and apes is shown by the number of incisors, or front teeth, being very frequently two on each side of both jaws, in place of the three which are so commonly present in other Mammals. In the apes and monkeys, however, the central pair of incisors in the upper jaw are in contact



SKELETON OF SQUIRREL-MONKEY (1), OF MUNGOOSE LEMUR (2), AND OF SLENDER LORIS (3).

with one another, while in the lemurs they are almost invariably separated by a gap in the middle line. This affords a ready means of distinguishing the skull of a lemur at a single glance from the skulls of almost all other Mammals except bats and some of the Insectivores. The lower front, or incisor, teeth of the lemurs shelf forward, after the manner we have already mentioned as characteristic of one group of the American monkeys (p. 172).

Many lemurs are purely nocturnal animals, and it was probably from this circumstance, coupled with their silent habits and stealthy movements, that Linnæus was induced to give them the name by which they are now universally known. It

is, perhaps, almost superfluous to mention that the name lemur is taken from the Latin term *lemures*, which, together with that of *larvæ*, was applied by the ancient Romans to such shades of the dead as were supposed to be of malignant propensities. It is somewhat curious that both these terms should have been introduced into zoological nomenclature; the former to denote the animals of the present group, while the latter is applied to the grub stage of insects.

Distribution Altogether, there are somewhere about fifty species of lemur-like animals, of which the distribution presents some very remarkable features. In the first place, they are all restricted not only to the Old World, but also to the southern regions of the great land masses of that hemisphere, none of them being found to the northward of the tropic of Cancer, while the tropic of Capricorn very nearly limits their southward range. Within this area a few species are found respectively throughout the warmer regions of Africa, and in Southern India and Ceylon, while their eastern limits are marked by the island of Celebes and the Philippines. In all these regions the number of species is comparatively few, and they form but an unimportant element in the general fauna of the country. The case is, however, very different in the great island of Madagascar, which is the headquarters of the whole group. Here we find them constituting no less than one-half of the entire Mammalian fauna of the island, being represented by six genera, which include more than thirty species; most of the other Mammals being comparatively small forms, unknown either on the continent of Africa or in Asia. The true lemurs occur only in Madagascar, and it is very remarkable that all the species of the group found in that island scarcely show any closer relationship to those of the African mainland than they exhibit to those of Asia. So abundant, indeed, are lemurs in Madagascar, that, according to Monsieur Grandidier, who has done so much to increase our knowledge of this group, at least one individual is almost sure to be found in every little copse throughout the island.

It will be evident that such a numerous population of helpless animals like lemurs could not exist in a land overrun with large carnivorous animals; and in the whole of Madagascar we find only a few civets and an allied creature known as the foussa. Now to account for these peculiar features—the absence of all large Carnivores, except civets, and the abundance of lemurs—we have to call in the aid of the geologist. He will tell us that lemur-like animals, accompanied by civet-like Carnivores, existed in England, France, and other parts of Europe during the early part of the Tertiary period. And we are accordingly led to conclude that the lemurs and civets of Madagascar obtained an entrance into that island, doubtless by way of Africa, at a time when that continent was still free from the presence of the large Carnivores and the host of hoofed Mammals which now form such a dominant feature in its animal population. After the lemurs and civets had obtained an entrance into Madagascar that country became separated from the adjacent mainland, and it has remained as an island ever since. There, secure from molestation, the lemurs have attained a development unequaled at any time in any part of the globe, and afford us an admirable instance of the importance a group of animals may attain when living under favorable conditions.

Habits

We have already said that many lemurs are essentially nocturnal creatures. To this we may add that they are all of essentially arboreal habits. Indeed, except when compelled to descend to the ground to obtain water, or for the purpose of crossing from one plantation or coppice to another, they but rarely leave the trees. Their diet is extremely mixed, scarcely anything coming amiss to them, as will be inferred when we mention that leaves, fruits, insects,



FEMALE BLACK LEMUR WITH YOUNG.

(From Sclater, *Proc. Zool. Soc.*, 1885.)

reptiles, birds' eggs, and birds themselves are eagerly consumed by most of these animals.

By the natives of Madagascar the lemurs are looked upon with suspicious awe, and are consequently but seldom molested. This is doubtless due to their nocturnal habits and ghost-like movements; while the large eyes essential to these and all other nocturnal creatures have perhaps contributed to this feeling. In Ceylon and India, as we shall subsequently see, the large glaring eyes of one of the prettiest of

the lemurs used to lead to the unfortunate creatures being put to a cruel death. None of the lemurs attain any very large size, and all of them, when unmolested, are perfectly harmless and inoffensive animals, except to the birds, reptiles, and insects upon which they prey. The nostrils of a lemur, which are always situated at the extremity of the muzzle, differ markedly in form from those of a monkey. In all the latter, whether they be thin nosed like the Old World kinds, or broad nosed like those of America, the nostrils are always more or less rounded in form, and thus approach to the human type. In lemurs, on the other hand, the nostrils are always in the form of a curved slit widest above, and with the convexity directed outwardly, as is well shown in the figure on p. 206. The nostrils of a lemur are in fact almost precisely similar to those of a dog or a cat, and we have in this another proof of a relatively low zoological position.

In the lemurs proper, the first point to be noticed is that the upper front, or incisor teeth are always two in number on either side of the jaw, and that the middle pair are separated from one another by a distinct gap. The upper premolar teeth may be either two, as in the Old World monkeys, or three, as in their cousins of the New World; the molars being invariably three in number. The front teeth in the lower jaw, together with the one corresponding to the tusk, or canine, always shelve forward and are of small size. This small size and shelving direction of the lower tusk render it necessary that some other tooth should be enlarged so as to bite against the upper tusk. And we accordingly find that the first premolar in the lower jaw takes on the form and size of a tusk, and bites against the true tusk, or canine tooth of the upper jaw. It has been mentioned in the introductory chapter that whereas true tusks, or canines, have usually but a single root, premolar teeth nearly always have two roots, except when there are four of these teeth, in which case the first generally has but one root. Now the tusk-like lower premolar of the lemurs has the usual two roots, and hence we have a ready means of distinguishing a lemur's skull from that of most other Mammals; that is to say, by the lower tusk having two distinct roots.

The last feature we shall mention as being distinctive of the lemurs proper, is that, with the exception of the second toe of the foot, all the fingers and all the toes have well-formed flattened nails like those of the majority of monkeys.

THE INDRI LEMUR

Genus *Indris*

The peculiar-looking animal represented in the illustration on the next page is one of the numerous lemurs from Madagascar, and occupies the proud position of being the largest member of the entire group. It is likewise the sole representative of its genus; and in scientific parlance is designated *Indris brevicaudata*, its second title referring to its apology for a tail. The name indri, or indris, is a corruption from the native name Endrina, used in certain districts by the inhabitants of Madagascar for this animal. In other districts it is, however, designated Babakoto, or "little old man."

The indri is the first of a group of three genera, restricted to Madagascar, which present certain characteristics in common not found in other lemurs: Among these characteristics the most obvious is the large proportionate size of the legs as compared with the arms. Another is, that with the exception of the great toe (which is capable of being fully opposed to the others), the toes of the foot are joined together by a web as far as the end of their first joints. For those who desire to enter more fully into the structure of these lemurs, it may be mentioned that the total number of the teeth in the adult condition is limited to thirty; the series being represented by the formula $i \frac{2}{1}, c \frac{1}{1}, p \frac{2}{2}, m \frac{3}{3}$. All the members of this group differ



THE INDRI LEMUR.
(One-eighth natural size.)

from the other lemur-like animals in that they do not give birth to more than a single young one at a time. From this circumstance, together with certain features in their structure, these indris are regarded as the most highly organized of all the lemurs, and are accordingly placed at the head of the list. They subsist exclusively on a vegetable diet.

The indri is sufficiently distinguished from the other two genera included in the group by its mere stump of a tail; although there are also certain other features which support its right to stand as the representative of a distinct genus.

We have already mentioned that the indri is the largest of all the lemurs; and in a fully adult animal the length of the head and body is about two feet. Although there is great individual variation in this respect, the indri is very strikingly colored. Very frequently the forehead is blackish, but, like the cheeks and throat, it may be gray. The head, shoulders, back, and arms are of a full velvety black; and the black ears are large and prominent, and covered with longer hairs than those on the head. From the loins to the tail there is a large triangular patch of either pure white or of a yellowish tinge; this patch terminates in front in a sharp point, and is bordered on all sides with black. The flanks are also light colored, and the dark bands which usually separate the light area of the loins from that of the flanks are continued down the front of the legs; but the sides of the legs are in general whitish, and their hinder surface gray; the heel being reddish. The hands and feet are black, and, unlike the specimen we figure, they are, as a rule, almost denuded of hair.

Such are the common colors in the larger number of specimens of the indri. In almost every flock, however, individuals are found in which the light-colored areas intrude more or less extensively upon those which are usually black; and from these intermediate forms a complete transition can be traced to others in which the whole of the fur is white. The intermediately colored individuals very generally retain the broad black streak down the front of the leg, and the black ears.

Instead of being distributed over the whole of Madagascar, the indris are confined to the forests on the east coast of the island; this restricted distribution being due to the great range of mountains running longitudinally through Madagascar, which cuts off these animals from the plains on the western side.

Habits In contradistinction to most of the lemurs, the indris are purely diurnal in their habits; they are commonly found in small parties of four or five, although during the day single individuals, more or less widely separated from their companions, may frequently be seen. Their general habits appear to be similar to those of the propithecques, to which we shall refer later on. Unless injured so badly as to be unable to make its escape, the indri does not give utterance to the least sound when wounded; if, however, it is so severely hit as to fall to the ground, which it will only do when its extraordinary powers of holding on to the branches of the trees are exhausted, it gives vent to piercing shrieks.

It is related by Grandidier that some of the inhabitants of Madagascar have an extraordinary superstitious veneration for the indri, and will on no consideration harm it. Different families assign different reasons for this special veneration; and while it may be of the most marked description in one village, in a neighboring one it may be totally wanting. The author referred to considers that it may be largely due to the plaintive and mournful cries with which these animals frequently make the forests resound,—cries which can be heard at great distances, and have a more or less marked resemblance to agonized human wailings.

THE PROPITHEQUES, OR SIFAKAS

Genus *Propithecus*

The sifakas, as they are called by the native inhabitants of Madagascar, constitute the only genus of this group of lemurs which is represented by more than a single species. Although closely allied to the indri, they are at once distinguished by their long tails; the muzzle is also rather shorter, and the ears are considerably smaller, and are partly concealed by the fur, as is shown in our figure of the head of one of the species. Their skin is of a deep black; but the general color of the fur is usually white, more or less tinged with yellow, and, in some individuals, passing into red or even black. The fur on the breast is always much thinner than that of other parts of the body.

Three species of the genus are recognized, which are restricted to different parts of the island; but of these species there are several more or less distinct races, which are likewise confined to particular localities. It has been observed that while those individuals of the several species which tend to assume a black coloration are found in the damper parts of the island, those which are most completely white frequent the drier regions at the northern extremity of Madagascar. The sifakas, as Grandidier observes, live in bands of from six to eight individuals. They are completely diurnal in their habits, and may be observed at



HEAD OF VERREAUX'S SIFAKA.
(After Grandidier.)

morning and evening, when the heat is not too great, leaping in the forests from tree to tree in search of food. At sunrise they may often be seen sitting on the horizontal bough of a tree, close to where it branches off from the main stem, with their long legs bent, so as to touch their chin, and their hands resting on their knees. At other times they will be seen sitting in the same position, but with their arms extended, so as to receive the genial warmth from the rising sun on their bodies. During the heat of the day they conceal themselves in the depths of the foliage. When sleeping, they incline the head forward on the chest, and

cover it with their arms; at the same time the tail is either curled up spirally between the legs, or allowed to hang straight down.

Their shelving lower front teeth are admirably adapted for removing part of the rind of the fruits on which they so largely subsist, and thus making an aperture through which the pulp is removed piecemeal. The skins of the fruits are always rejected; and it is stated that sifakas exhibit a marked preference for green rather than ripe fruit.

In all ways they are admirably adapted for a purely arboreal life. So strong indeed are their hind limbs that they can readily take leaps of from ten to eleven

yards in passing from bough to bough; and so rapid are their motions that Grandidier speaks of them as appearing to fly rather than leap. On the rare occasions when they descend from their favorite trees, they advance by means of long leaps, as owing to the shortness of their arms it is not easy for them to walk on the ground on all fours like the majority of monkeys. To see them, observes Grandidier (from whom the whole of this account is taken), resting on their hind feet, and at each leap throwing up their arms in the air, the spectator might be led to think for a moment that he was looking at children at play. Indeed, a troop of these creatures advancing across the plains in the manner described, is said to be a truly ludicrous sight. Not only are the hands of the sifakas of no use to their owners in walking, but they are almost equally useless as organs of prehension; and when a sifaka has occasion to pick up a fruit from the ground, he will usually stoop down and seize it in his mouth. When conveyed to the hand, such an object is grasped between the bent fingers and the palm, and not between the fingers and thumb. As purely grasping organs, adapted to afford a firm hold to the branches of trees, both the hands and feet of these lemurs are, however, perfect.

In disposition the sifakas are described as being gentle, and they but seldom attempt to bite, while if they do so the wound they inflict is not serious. At certain seasons, however, the males are wont to engage in contests among themselves, the results of which are frequently visible in their torn and tattered ears. Unlike many other lemurs, they are, as a rule, silent; but when frightened or angry they give vent to a low cry somewhat resembling the clucking of a fowl. In a word, so far as character goes, these animals may be described as being but little active, but little restless, and but little intelligent.

Diademed Sifaka The diademed sifaka (*P. diadema*), known to the natives of Madagascar as the simpona, is the largest of the three species, and at the same time the one which was first brought to the notice of science, having been described by E. T. Bennett in the year 1832. It takes its name from the band of white hairs running across the forehead, which, with the gray fringe of hair on the cheeks and chin, surrounds the black face, and thus gives to the animal a peculiar and striking physiognomy. The crown and back of the head, together with the outer surface of the ears and the nape of the neck, are a dark brown color, and the same tint extends over the shoulders, so as to give somewhat the appearance of a mantle, and ends in a point on the back; this point in some individuals being only just below the neck, while in others it reaches as far back as the loins. Occasionally this dark mantle-like area, instead of being dark brown, is of a gray tint. The loins and flanks are generally gray, varying considerably in different individuals, the gray passing gradually into the brown of the back and the orange round the tail, and extending to the upper parts of the arms, or even enveloping the whole of the upper arm. The fore-arms, together with the region round the tail and the legs, are generally of a bright orange yellow, although occasionally yellowish white with some intermixed black hairs. The hands are mainly black, but the feet have a good deal of yellow in them; the basal half of the tail is yellowish, while the rest of it is gray.

Such are the colors of the typical form of this species. In the moist regions of the south of Madagascar there is, however, a nearly or quite white race of this lemur, while in the dry regions of the north there is a black race; in each case intermediate forms occurring which connect these varieties with the ordinary type.

The diademed sifaka inhabits the narrow strip of forest-land extending along the whole length of the eastern coast of Madagascar, and bordering the chain of granite and slaty mountains which dips down towards the sea on the east, and is the cause of almost daily rain. It is where this chain almost dies out at the northern end of the island that the black race occurs.

This and the next species, which are smaller than the last, and are those which are known to the natives as the sifakas, are restricted to the western and southern coasts of Madagascar. Here they are only found in the thick forests which here and there occur among the desolate solitudes of the western and southern sides of the island,—regions of sandy plains where fertilizing rains but seldom occur.

The fur of *P. verreauxi* (of which the head is figured on p. 206) is woolly and soft to the touch; its color being typically white with a faint tinge of yellow. The summit and hinder part of the head are, however, often of a maroon color, and more rarely reddish, while some individuals show more or less marked gray tints in various regions of the body. In no case, however, does the brown of the head ever extend on to the neck and back, as it does in the diademed species. There are two well-marked varieties of this species, one being pure white, with the exception of patches of bright red on the arms and thighs.

A writer relates how he once had for some time two females and their young of this species in a cage. "Nothing was more touching than to see these poor mothers holding their young lying in their arms. At the least movement, the young sifaka left its mother's breast and leaped upon her back, where with its hands resting on her shoulders, and its feet buried in her fur, it took so firm a grasp that it was impossible to make it leave go; and one could thus readily understand how that, whatever leaps the mother might take, the offspring would never be unseated."

The last species of the propithecques (*P. coronatus*) agrees in size with the preceding, to which it is closely allied. It has, indeed, a crest of long blackish hairs on the forehead, from which it derives its name; but since a similar crest is found in some individuals of Verreaux's sifaka, this cannot be taken as the ground for specific distinction. Neither can its coloration, peculiar though it be, form the distinction, since the difference in this respect from the typical form of the latter species is scarcely if at all greater than that occurring between the various races included under that heading.

It is, indeed, mainly from the characteristics of the skull that the crowned sifaka is ranked as a distinct species. Thus the skull is altogether larger than that of the preceding species in addition to which it has a proportionately larger muzzle; while there are other distinctive features, into the consideration of which it would be beyond the scope of the present work to enter.

In color, the forehead, the crown of the head, and the cheeks are blackish brown; in bold contrast to which stands out the white fur with which the ears are

covered. The neck and upper parts of the body, as well as the limbs, are of the same white color, having a more or less distinct rosy tinge on the limbs and at the root of the tail; this rosy tint being most distinct in the more southern race of this species, in which it may extend on to the back. There is a patch of gray or brown, varying in size, on the nape of the neck. The tail and hands are invariably pure white.

This species is restricted to a small area on the northwest coast of Madagascar, situated to the northeastward of Cape St. André, and bounded on the east by the river Betisbooka, and by the Manzaray river to the west.

In concluding their notice of these animals, Messrs. Milne-Edwards and Grandidier remark how curious it is to find the various races and species so sharply separated from one another that it is sufficient to cross a river—it may be of no great width—in order to find that, while on one bank all the sifakas belong to one race, on the opposite bank they will be of another race, if not of a distinct species. No satisfactory explanation of these peculiar features in topographical distribution has, however, suggested itself to the authors quoted.

THE AVAHI LEMUR

Genus *Avahis*

The third and last genus of the present group of lemurs is represented only by the avahi or woolly lemur (*Avahis laniger*); a species discovered at the same time as the indri in the year 1870 by the French traveler Sonnerat. The avahi, although furnished with a long tail like the sifakas, is readily distinguished by the still shorter muzzle, and also by the ears being completely concealed by the fur, which is of a woolly instead of a silky nature. Although these differences are amply sufficient to distinguish the avahi from the sifakas when they are seen together, it is not on these alone that the zoologist relies when referring them to distinct genera. There are, indeed, well-marked differences in their teeth; but it will be sufficient for our present purpose to merely record the existence of these points of distinction. The avahi differs, moreover, from all the other members of the group to which it belongs in being of nocturnal instead of diurnal habits.

The avahi is the smallest member of all this group of lemurs, its dimensions being rather less than two-thirds of those of the diademed sifaka. In color, the long hairs on the forehead immediately above the eyes are gray at the base and pinkish at the tips; while there is in some individuals a small white or yellowish band, more or less irregular, across the crown of the head. The rest of the head, the neck, the back, and the arms are covered with woolly fur, of which the individual hairs are gray at the roots, reddish in the middle, and black at the tips; an arrangement which communicates a peculiar appearance to the whole fur. The concealed ears are reddish, and the cheeks gray. The loins and flanks are of a much lighter color than the back, especially in the region of the tail, where there is a large triangular patch of pinkish white running forwards into the dark area of the body. The hind limbs are still lighter in color, and as the hairs here tend to

grow into bunches or tufts, they reveal their gray bases and pinkish tips, thus giving to the pelage a mottled appearance. The bushy tail is of a decidedly pink tint, more especially for the first third of its length. The hands and feet are reddish.

There are, however, great variations of color among different individuals of the avahi, inhabiting even the same district; some having the pelage almost uniformly reddish, while in others all the parts above the thighs are nearly pure white.

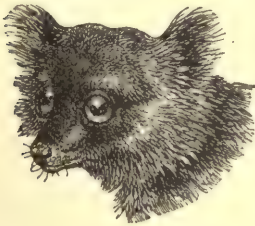
According to Messrs. Milne-Edwards and Grandidier, the avahis, instead of living in small troops like the indris and sifakas, are found either solitary or in pairs. They are completely nocturnal, sleeping during the day curled up in the fork of a branch, and issuing forth in search of food with the falling shades of evening. Like their allies, they are sluggish in their movements, and but seldom descend to the ground; and, when they do so, they walk in the same peculiar manner as the sifakas.

The avahis are found in two parallel bands of forest on the east side of Madagascar, and also in the woods of a small area on the northwest. They are, however, totally unknown on the west and south coasts, where the vegetation and climate are totally different. The members of the colony on the northwest coast are of smaller size and somewhat different coloration from those on the east side of the island. From their smaller size and nocturnal habits, the avahis are less noticed by the natives of Madagascar than are the other members of this group, and do not figure conspicuously either in their legends or in their superstitions. The name avahi is the one by which they are known to the Antanala tribe. By other tribes they are, however, termed Ampongi, Fotsi-fe, or Fotsi-afaka; the two latter terms respectively meaning "white legs" or "white fork," in allusion to the peculiar coloration of the hinder parts of these animals.

THE TRUE LEMURS

Genus *Lemur*

With the true lemurs, which are likewise confined to the island of Madagascar, we come to the first of a group differing in several respects from those already



A



B

HEADS OF COMMON (A) AND SMOOTH-EARED (B) BLACK LEMUR.

(From Sclater, *List of Animals in Zool. Gardens.*)

noticed. The first and most easily recognized feature by which the true lemurs and their allies may be distinguished from the group containing the indri and the avahi, is that the toes of the foot are not connected at their bases by a web. In none of those animals are the legs so long in proportion to the arms as we have seen to be the case in the

members of the preceding group; while the whole of them have long tails. Then again it may be mentioned that the members of this group are distinguished by

the presence of an additional front tooth on either side of the lower jaw, and likewise by having one more premolar tooth on each side of both jaws; thus bringing up the total number of teeth from thirty to thirty-six. The formula is $i\frac{2}{2}$, $c\frac{1}{1}$, $p\frac{3}{3}$, $m\frac{3}{3}$; which may be compared with that given on p. 204, as distinctive of the indri group.

The true lemurs are confined to Madagascar and the Comoro islands, which are situated halfway between it and Zanzibar. Although some of them are nocturnal, and others diurnal in their habits, all these lemurs differ from the indri group in subsisting on a mixed diet; insects, small reptiles, birds' eggs, and the callow young of birds, forming at least as important a part of their food as fruits. It is probably owing to this mixed diet that they are of a much hardier disposition than are those of the indri group, so that they flourish in confinement in this country so well as not unfrequently to breed; the number of young produced at a birth being either one or two.

In consequence of their arms being longer in proportion to their legs than in the indri group, the true lemurs and their allies when on the ground are in the habit of going on all fours, although capable of taking leaps of great length. The true lemurs may be distinguished from the other members of the group to which they belong by the length of their snouts, and the large size of their tufted ears, as well as by their diurnal habits.

RING-TAILED LEMUR (*Lemur catta*)

One of the best known, and at the same time the most easily recognized of all the true lemurs, is the ring-tailed lemur, represented in the figure on the next page. This animal, which may be compared in appearance to a very small fox, is of an ashy gray color, darker on the back, and white on the under parts, as well as on the sides of the face, ears, and the middle of the forehead. Its most distinctive feature is, however, to be found in the alternate rings of black and white on the tail, from which it derives its name. It has no fringe round the face.

The ring-tailed lemur is found in the central parts of Madagascar, ranging on the west coast to Mouroundava, and on the east coast to Andrahoumbe. Like the other members of the group, this lemur lives in small parties, and is most active at early morning and evening; sleeping during the night with its bushy tail curled round its body, and likewise taking a siesta during the heat of the day. Unlike the members of the indri group, it is a noisy creature; and the whereabouts of a troop in the morning or evening is discoverable by the loud cries which they are continually uttering.

In captivity this species thrives well, and it is generally numerous represented in the menagerie of the London Zoological Society, although it does not appear that it has ever bred there.

Mr. G. A. Shaw, writing of ring-tailed lemurs, states that they are found only in the south and southwestern borders of the Betsileo province of Madagascar. This province is about one hundred and fifty miles in length, by fifty or sixty in width, and is situated on the central table-land, about one hundred to two hundred and fifty miles south of Antananarivo, the capital of Madagascar. A forest extends

along the whole eastern side of this province, fringing the table-land, and covering all the slopes down into the lowland bordering the sea ; but nowhere in these forests have the ring-tailed lemurs been found. Their habitat in the south and southwest is among the rocks ; over which they can easily travel where it is impossible for the people, although barefooted, to follow. An examination of their hands will show that they are pre-eminently adapted for this kind of locomotion. The palms are long, smooth, level, and leather-like, and enable the animal to find a firm footing on the slippery wet rocks, very much on the same principle as that which assists the fly to walk up a pane of glass. The thumbs on the hinder hands are very much smaller in proportion than in the lemurs inhabiting the forests, which depend upon their grasping power for their means of progression. These spring from tree to



THE RING-TAILED LEMUR.
(One-seventh natural size.)

tree, and rarely, if ever, touch the ground, except in search of water. Hence the ring-tailed lemurs are an exception to the general habits of the *Lemuridae*, in that they are not arboreal. There are very few trees near their district ; and those which do grow there are very stunted and bushy.

OTHER SPECIES

Red-Fronted Lemur The whole of the other species of true lemurs are readily distinguished from the preceding by their uniformly colored tails. The number of nominal species is, however, too large to permit of reference to all of them, and the one which we select as the next representative of the genus is the red-fronted lemur (*L. rufifrons*).

This lemur may be easily recognized by the two small white stripes running across each side of the rump. The general color of the fur is gray; the throat and under parts being reddish; the nose and the middle of the forehead black; while the sides of the nose, the cheeks, and a large spot on either side of the forehead are white. The tail is blackish, with a reddish tinge at the root.

The species represented in the accompanying figure (*L. mungoz*), was described as far back as the time of Linnæus. It inhabits the western coast of Madagascar, and may always be known by its black nose and the iron-gray spot on each side of the forehead. The fur, which is of a somewhat woolly nature, is reddish gray in general color; but the face, chin, the



THE MUNGOOSE LEMUR.
(One-seventh natural size.)

middle line of the forehead, and a streak across the crown of the head, are black, while the cheeks and sides of the forehead are gray. There is considerable individual variation in the width of the black band across the head.

The white-fronted lemur (*L. albifrons*) appears to be restricted to the northeast coast of Madagascar. It is mainly distinguished from the allied species by its color; its most distinctive feature being a broad band of white woolly hairs extending across the forehead, and including the base of the ears, the cheeks, and part of the throat and neck. The prevailing color of the back and flanks is a grizzled brown, tinged with red; the long muzzle and face, together with the hands and feet, and the end of the tail being black. The under parts and inner surfaces of the limbs are whitish gray. This pretty lemur

was first described by the French naturalist Geoffroy St. Hilaire, and was exhibited in the London Zoological Gardens as far back as 1830.

Black-Fronted Lemur This (*L. nigrifrons*) is another closely allied lemur, also first made known to science by the naturalist last mentioned. In comparing it with the preceding species, E. T. Bennett, who had the opportunity of seeing living examples of both, observes that "their size, it is true, is nearly equal, and there is little, if any, difference in their form; but their colors, invariable as we have hitherto found them, furnish sufficient ground for regarding them as distinct. The present animal has the elongated muzzle of the last, but the black color embraces in it the forehead and sides of the face, as well as the base of the muzzle; and the hair on the former parts, instead of being long and woolly, is short, smooth, and even. While the black is thus extended backwards over the head, it is bounded on the fore part of the muzzle, which instead of being uniform in color, as in the preceding species, becomes grizzled towards its extremity, and at last almost white. The general color of the upper parts of the body is a dark ashy gray, most of the hairs terminating in a tawny tip, which is so strongly marked on the back as to give a decided tinge. The tail is light gray at the base, and darker towards the tip; the outside of the limbs is of a light ashy gray; the chin, chest, and throat are pure white; and the under parts, together with the inner side of the hind limbs, pale rufous. The hands, which are blackish, have the same tendency to become grizzled as the fore part of the muzzle."

In captivity this and the preceding species are described as being perfectly tame and good-natured, without any tendency to the petulant and mischievous habits of the smaller monkeys. In a wild state the habits of these allied species are doubtless similar.

BLACK LEMUR (*Lemur macaco*)

With the black lemur, which is represented in the accompanying figure, we come to the first of a group of three very well-marked species, differing considerably from those already noticed; this difference being chiefly shown by the presence of a more or less well-marked ruff fringing the cheeks and chin, and frequently also by a fringe of hairs on the margins of the ears. Moreover, all these lemurs are subject to great variation in color, which in one case appears to be merely individual, while in another it is distinctive of the two sexes. So great, indeed, is this variation, that the two species of which we shall treat have been described under at least four distinct scientific names; thereby showing how great is the need of caution in such matters.

The black lemur comes from the northwest coast of Madagascar; and the male, upon the evidence of which the species was originally described, is of a uniform black color, with a well-developed ruff round the cheeks and neck, and a long fringe to the ears. Very different, however, is the female, which was at first described under the name of the white-whiskered lemur (*L. leucomystax*). In this sex the general color of the fur is brown, with a patch on the lower part of the back, and the ruff round the face and the fringe on the ears are white.

A female of this species in the Gardens of the London Zoological Society twice gave birth to a young one, and thus afforded an opportunity of seeing the curious manner in which the true lemurs carry their offspring. This is shown in the cut on p. 202. The young one born on the twenty-fourth of March 1884 proved to be a female, and was of the same brown color as its mother. On the third of April in the following year the second young one was born, which was a male, and at the time of birth it was of the black hue of its father. Each of these young ones was



THE BLACK LEMUR.
(One-sixth natural size.)

carried lying nearly across the abdomen of its mother, with its tail passed round her, and thus on to its neck, so as to afford a firm attachment; and it is believed that, at least in the wild state, the young are at a later period carried on their mother's back.

A nearly allied lemur, of which the male was described by Dr. Sclater, may be called the smooth-eared black lemur (*L. rufipes*), and is distinguished by the smaller size of the ruff round the throat, and the absence of a fringe on the ears of

the male ; the difference in the heads of the two forms being shown in the figure on p. 210. The female of this lemur was described by Dr. Gray, and has reddish feet.

THE RUFFED LEMUR (*Lemur varius*)

The last, and at the same time the largest, of the true lemurs is the ruffed lemur, which inhabits the northeast coast of Madagascar. As its name implies, it is remarkable for the extraordinary individual variation in the color of the fur ; such variations being apparently independent of sex. Frequently the color is a mixture of black and white, disposed in patches on different parts of the body, but occasionally white individuals are met with. Other individuals are, however, of a nearly



THE RUFFED LEMUR.
(One-seventh natural size.)

uniform reddish-brown color ; this variety having been regarded as a distinct species, under the name of the red lemur (*L. ruber*).

A specimen of the red variety in the Menagerie of the London Zoological Society had the upper surface of the body of a bright rufous brown, while the under parts were of a deep black. The reddish area included the sides of the face, ears, back, and flanks, and the outer surfaces of the limbs ; while the black embraced the forehead and face, the throat, chest, and abdomen, the inner surfaces of the limbs, and the hands and feet, with the exception of a narrow stripe of white across their upper surface. On the back of the neck there was a large white patch. The length of the head and body of this animal was two feet, and that of the tail somewhat more.

THE GENTLE LEMUR

Genus *Hapalemur*

The gentle lemur (*Hapalemur griseus*), like all the members of the group under consideration, is an inhabitant of Madagascar, but differs so decidedly from the true lemurs that it has been made the type of a distinct genus, of which it is the only well-defined species.



THE GENTLE LEMUR.
(One-fourth natural size.)

It may be readily distinguished from the true lemurs by its rounded head and extremely short muzzle, the ears being likewise very short. A peculiar feature is the presence of a small bare patch on the front surface of the fore-arm, a little above the palm of the hand, which is covered with small spines. The color is a dark iron

gray, with a tinge of yellow, becoming somewhat paler on the under parts and the inner sides of the limbs. The individual hairs are black, with a reddish band near their tips.

The species differs from the true lemurs in being purely nocturnal in its habits. It is chiefly found in bamboo-jungles, and subsists mainly on the young tender shoots of these plants, as well as on their leaves. In such jungles its capture is difficult, and hence living examples are rare in our menageries. One living in the Zoological Society's Gardens in the year 1870 was regarded by the late Dr. Gray as a new species, and described as the broad-nosed lemur (*H. simus*), but it does not appear to be more than a variety. According to a French traveler, the gentle, or gray lemur is known to the natives of Madagascar as the Bokombouli.

THE WEASEL-LEMUR

Genus *Lepidolemur*

The slender, or weasel-lemur, is the last representative of the present group, and belongs to a genus containing two species, which differ from all other lemur-like animals in having, when adult, either no upper front (incisor) teeth at all, or merely a single pair of minute rudimentary ones. This characteristic will at once suffice to distinguish these animals from the gentle lemur, which they resemble, however, in being of purely nocturnal habits. A further distinction is afforded by the greater length of the muzzle; and also by the ears being bald and somewhat larger. The tail is long, and covered with close-set short hair.

The weasel-lemur (*Lepidolemur mustelinus*) is chiefly found in the northwest of Madagascar, and is characterized by having no upper front teeth at all when quite full grown. Its head and body together measure about ten inches in length, while the length of the tail is fourteen inches. This is one of the lemurs which are subject to great individual variation of color, in consequence of which it has received several distinct scientific names. In one variety the general color of the upper parts is dark gray tinged with yellow, the back having a darker stripe, while the under parts, as well as the throat, are whitish gray. The dark stripe on the back may, however, be wanting; and some specimens are redder above and yellower beneath; indeed, scarcely any two individuals are alike in these respects.

The weasel-lemur, during its nocturnal rambles, is marvelously active, and is capable of taking tremendous leaps among the trees in which it dwells; its slender build and long limbs being admirably adapted for such a mode of progression. Like the gentle lemur, it subsists solely on leaves; and it is much sought after as an article of food by the natives of Madagascar, to whom it is known by the name of Fitili-ki. It is killed by being knocked on the head with a stick while curled up during the day in its nest of leaves, to which it has been tracked down at the end of its nocturnal excursions.

The hoary-headed lemur (*L. caniceps*) is a closely allied species, chiefly distinguished by having a minute rudimentary pair of front or incisor teeth in the upper jaw, but further characterized by the hoary gray of the hair on the crown of the head.

THE MOUSE-LEMURS

Genus *Chirogaleus*

With the tiny creatures known as the mouse-lemurs, we come to the first of a group of two genera which differ from all the members of the lemur tribe in that the bones of the upper part of the ankle are enormously elongated, thus causing the whole foot to be much longer than in the preceding groups.

The mouse-lemurs themselves are confined to Madagascar, and include the smallest of the lemurs, some of them being even inferior in size to a rat. They have long tails, and rather large ears, which are hairy at their base, and cannot be folded upon themselves.

The most remarkable feature connected with the mouse-lemurs, and one for a knowledge of which we are indebted to the observations of Grandidier, is that they are in the habit of what is generally called hibernating, or remaining dormant for a portion of the year. But as their quiescent season is during the hottest and driest time, the term æstivation would be more appropriate. By no means all the mouse-lemurs thus hibernate; and we may fairly presume that the species in which this habit occurs are those dwelling in the more arid regions. To prepare for this protracted period of dormant energies, during which they maintain the heat of their bodies by the consumption of their own substance, the mouse-lemurs feed so vigorously that when the hot season arrives they are in an extremely fat and sleek condition. Curiously enough the great accumulation of fat which then takes place is mainly restricted to the region of the base of the tail; and when they retire at the close of the rainy season, during which food is extremely abundant, their tails are swollen to a prodigious size. The wasting process which goes on during hibernation leaves them, however, with their tails shrunk to a very small diameter. In order to make themselves comfortable during their long sleep, they follow the example of our own dormice, and prepare snug little nests of twigs and other substances; some of their habitations being described as marvels of neat construction. Their food is mainly of a vegetable nature; although this diet is largely supplemented by insects, and even small birds are said not to come amiss. Having large round eyes, by which they are enabled to see small objects in the darkest nights, they are in the habit of stalking nocturnal moths and beetles when settled on the boughs of trees, and then rushing upon and seizing them with a final spring.

The largest, and at the same time one of the longest known of the mouse-lemurs is the species (*C. furcifer*) represented on p. 220, which takes its name from the black streak running down the middle of the back, and dividing on the top of the head so as to form a distinct fork-like mark

Forked Mouse-
Lemur

between the eyes. The color of the remainder of the body is gray, with a black tip to the tail.

This species is found in the forests on both the east and west coasts of Madagascar, though more abundant in the latter region. It is known to the natives as the Walouvi, and is not one of those species that hibernate.



THE FORKED MOUSE-LEMUR.
(One-fourth natural size.)

This species (*C. murinus*) differs from the preceding by the absence of the dark stripe down the back. The general color is a pale reddish gray, with a broad whitish streak up the middle of the face; the cheeks and under parts being also light colored, but the slender tail more brown. The mouse-lemur represented in the figure on the opposite page, which is often described as the myoxine mouse-lemur (*C. myoxinus*), appears to be very closely allied to this species.

Murine Mouse-
Lemur

Coquerel's Mouse-Lemur This mouse-lemur (*C. coquereli*) is characterized by the soft and woolly nature of the fur, of which the prevailing color is grayish brown, tinged with gold. It makes well-formed nests, composed of twigs, dead leaves, and grass, and having a diameter of some eighteen inches. In this nest it sleeps during the day, to prowl forth at night in search of food.

Brown Mouse-Lemur Another mouse-lemur (*C. milii*), which is one of the hibernating species, takes its name from M. Milius, a governor of Reunion, in the first quarter of the present century, by whom two of these creatures were sent to Paris. They were described by Frederic Cuvier in the year 1821 as the



THE MURINE MOUSE-LEMUR.
(One-half natural size.)

maki nain, or small lemur. The species is some nine inches in length, exclusive of the long tail; and it is of a grayish-brown color, with black whiskers, and white throat and under parts; the fur being silky. The specimens sent to Paris throve for some time, and became so tame that they were allowed to leave their cages. They would, however, only play about if the apartment was kept perfectly dark and still; and when this was done they could be heard frolicking in high glee. During the day they rolled themselves up into a ball and slept.

Dwarf Mouse-Lemur The smallest of all is the dwarf mouse-lemur (*C. pusillus*), not unfrequently referred to as the Madagascar rat, on account of its having been described by Buffon under the name of *le rat de Madagascar*. The head and body of this diminutive representative do not exceed four inches in length, while the tail measures six inches. The prevailing color is a pale gray; the chin and under parts being pale yellow, and the outer surface of the ears light brown, while a white streak runs up the nose and between the eyes. The eyes themselves are surrounded by black rims, giving to the face the appearance of wearing a pair of spectacles.

The dwarf mouse-lemur builds beautifully constructed nests of twigs, lined with hair, in the tops of the lofty trees where it delights to dwell. These nests somewhat resemble those of a rook, both in form and size, and are used, not only as diurnal resting-places, but as cradles for the young. The species is remarkable for the extreme beauty of its brilliant eyes.

Mr. G. A. Shaw writes that the dwarf lemurs "inhabit a belt of forest-land stretching from the eastern forest into the heart of Betsileo, a few miles north of Fianarantsoa, where they are tolerably abundant. They live on the tops of the highest trees, choosing invariably the smallest branches, where they collect a quantity of dried leaves, and make what looks from below like a bird's nest. So close is the resemblance, that it requires good eyes to distinguish the one from the other. Their food consists of fruit and insects, and most probably honey. I have frequently seen them catching the flies that have entered their cage for the honey; and I have supplied them with moths and butterflies, which they have devoured with avidity. They are extremely shy and wild. Although I have had between thirty and forty caged at different times, I have never succeeded in taming one. They are also very quarrelsome, and fight fiercely, uttering a most piercing, penetrating sound, somewhat resembling a shrill whistle."

THE GALAGOS, OR AFRICAN LEMURS

Genus *Galago*

The galagos are the only long-tailed lemurs found throughout the length and breadth of Africa. The name is said to be that by which one of the species is known to the natives of Senegal. They resemble the mouse-lemurs in having the bones of the upper half of the ankle greatly elongated, and thus have the same lengthy foot. Although some are much larger, there are others quite as small as the smaller mouse-lemurs. There is, however, a readily recognized external character by which a galago can be at once distinguished from a mouse-lemur. This consists in the large size of the ears, which are quite bare, and have the unique peculiarity that they can be partially folded upon themselves at such times as their owners please, so as to lie nearly flat upon the sides of the head. This may be for the purpose of protecting these delicate organs when passing through thick foliage, especially if wet.

This distinctive peculiarity of the ears is, of course, sufficient to enable us at once to separate a galago from a mouse-lemur, and, indeed, from every other kind of lemur. Zoologists are, however, by no means satisfied with distinguishing animals merely by external characters; and they have succeeded in finding a feature in the teeth by which a galago differs markedly from a mouse-lemur, although, unfortunately, this point of distinction can only be seen in a dried skull. If, however, we take the skull of a mouse-lemur, we shall find that while the last three upper teeth, or molars, have broad crowns and are alike, the tooth in advance of these, which is the last premolar, has a smaller and simpler crown, of a triangular shape. In a galago's skull, on the contrary, this last upper premolar, although slightly smaller than the molars, has a similarly shaped crown, broad on the inner side, and nearly quadrangular in shape.

The galagos are widely distributed over the "Dark Continent," one kind being found as far south as Natal, while there are several on the western side and two on the eastern. Like the mouse-lemurs, they are essentially nocturnal; and are, of course, confined to those regions where thick forest prevails. When not enjoying their diurnal repose, they are lively and interesting. They subsist on a mixed diet, including fruits, insects, and small birds and their eggs. Some of the smaller species will readily devour locusts, and the peculiar leaf-like mantides, or praying insects. When on the ground the galagos recall the lemurs of the indri group, in that they generally sit in the upright position, and progress by a series of leaps or hops. They usually have two or three young at a birth, and are stated to have bred in captivity in Africa, although we are not aware whether they have done so in Europe. Many of them, however, thrive well in our menageries, where some have been represented by a considerable number of individuals. It is stated that the galagos resemble the mouse-lemurs in building nests, which are situated in the forked branches of trees; but it is probable that this is only true of the smaller species. They appear, however, to be peculiar in that several individuals will inhabit the same nest, out of which they all rush when suddenly disturbed. The total number of teeth, both in the galagos and the mouse-lemurs, is the same as in the true lemurs.

THE GREAT GALAGO (*Galago crassicaudata*)

With the exception of a closely-allied kind from the West Coast, the great, or thick-tailed galago, of Mozambique and the Lower Zambesi valley, is the largest of all the species. This animal, of which a figure is given on p. 224, is, in point of size, about equal to a cat of average dimensions; and, indeed, the peculiar manner in which it carries its thick bushy tail high above its back is highly suggestive of a pampered Persian cat. This bushy tail is about one-fourth longer than the head and body. The great galago belongs to a group of three or four species, in which the ears are unusually long, and the muzzle is considerably elongated, while the feet are comparatively broad and short, and the fingers and toes have broad disk-like expansions at their extremities. The color of the fur is a uniform dark brown.

Writing of this species, Sir J. Kirk observes that "it is confined to the maritime region, so far as I know never penetrating beyond the band of wood generally known as the mangrove forests. By the Portuguese it is named 'rat of the coconut palm,' that being its favorite haunt by day, nestling among the fronds; but if it be disturbed, performing feats of agility, and darting from one palm to another, it will spring with great rapidity, adhering to any object as if it were a lump of wet clay. It has one failing, otherwise its capture would be no easy task. Should a pot of palm wine be left on the tree, the creature drinks to excess, comes down, and rushes about intoxicated. In captivity they are mild, during the day remaining either rolled up in a ball, or perched half asleep, with ears stowed away like a



THE GREAT GALAGO.
(One-sixth natural size.)

beetle's wing under its hard and ornamented case. I had half a dozen squirrels with one in the same cage; these were good friends, the latter creeping under the golgo's" [Sir J. Kirk's way of spelling galago] "soft fur and falling asleep. On introducing a few specimens of (elephant) shrew, the golgo seized one and bit off its tail, which, however, it did not eat. The food it took was biscuit, rice, orange, banana, guava, and a little cooked meat. Stupid during the day, it became active at night, or just after darkness set in. The rapidity and length of its leaps, which were absolutely noiseless, must give great facilities to its capturing live prey. I never knew it to give a loud call, but it would often make a low, chattering noise.

It has been observed at the Luabo mouth of the Zambesi, at Quillimane, and at Mozambique. When I had my live specimen at Zanzibar, the natives did not seem to recognize it ; nevertheless, it may be abundant on the mainland."

On the west coast of Africa, in Angola, the great galago is represented by the closely allied Monteiro's galago (*G. monteiri*), which is of slightly larger size than the east coast form ; the length of the head and body being twelve, and that of the tail sixteen inches. Although these two galagos differ mainly or entirely by their coloration, yet, according to Sir J. Kirk, the eastern form is confined to the coast region, and it is probable that there is a wide area separating the habitats of the two, which suggests the advisability of regarding them as distinct species. As a rule, Monteiro's galago is of a uniform pale gray color, with the sides of the nose somewhat darker, and the throat and tail nearly or quite white. The fur is soft, with the component hairs slate colored at their roots, and white at the tips.

GARNETT'S GALAGO (*Galago garnetti*)

Garnett's, or, as it is sometimes rather inappropriately called, the black galago, is a species belonging to the same group as the preceding forms, from which it differs by its inferior size. It is an inhabitant of Eastern Africa, and is of a dark brown color, tending to yellowish on the under parts, with black ears, and a white streak on each side of the loins.

One of these animals, formerly in the London Zoological Society's menagerie, when let loose one night in the apartments of the superintendent, exhibited to perfection the leaping habits and extreme agility characteristic of its tribe. It leaped after the manner of the kangaroo, clearing several feet at a single spring, and hopping on the table and other articles of furniture which were in the room. Strange to say, it exhibited no signs of fear of the dogs and cats with which it was confronted.

The pale colored galago (*G. pallida*), of Western Equatorial Africa, is a species connecting in some respects the three above-mentioned species with those of the group now to be described. It was met with by Du Chaillu, who believed that he had discovered a new species. The general color is pale gray, and the tail unusually long.

ALLEN'S GALAGO (*Galago alleni*)

With the West African species we come to the first representative of a group distinguished from the preceding one by the more rounded head, shorter muzzle, and larger eyes, as well by the longer and more slender form of the foot.

Allen's galago is found at Fernando Po and the Gabun, and is characterized by the tail being thick and bushy, and also by the extreme length and slenderness of its fingers and toes. The prevailing color of the fur is blackish brown, with the forehead, rump, and the root of the tail gray ; a tinge of red is on the limbs, the tail is black, and a streak on the nose and all the under parts are whitish.

If we examine the skull of this species, it will be noticed that the last molar tooth on each side of the upper jaw is nearly equal in size to the tooth

in advance of it. This will be found an important point of distinction between Allen's galago and all the remaining species, in which the last upper molar is much smaller than the tooth in front of it.

THE SENEGÁL GALAGO (*Galago senegalensis*)

The longest known of all the galagos is the Senegal galago. It was originally described so far back as the year 1796, from specimens brought from Senegambia,



THE SENEGAL GALAGO.
(One-half natural size.)

which may be regarded as its headquarters. Subsequent discoveries have, however, shown that a galago exists on the east side of Africa to the south of the Sudan, which, although described as a distinct species under the name of the Sennaar galago (*G. sennariensis*), is so closely allied to the Senegal galago that it may probably be regarded as a mere local variety or race. Indeed, it is probable that when we are fully acquainted with the zoology of the vast stretch of country lying to the south of the Sahara desert, it will be found that this galago extends right across Africa.

In addition to the distinctive character of the upper molar teeth already mentioned, the Senegal species has certain marked external features by which it differs from Allen's galago. Thus, in the tail the hairs near the root are pressed down, only those nearer the end spreading out on all sides, so that the whole tail assumes a somewhat club-like form. Then, again, the fingers and toes are considerably thicker and shorter than in Allen's galago. In color the typical Senegal galago is gray, with the under parts and a streak on the nose white, and the tail, hands, and feet blackish brown. The Sennaar race appears to have a rather bluer tinge to the fur, with a darker face, and black rings round the eyes; while the tail is described as being relatively longer. It is of comparatively small size, and appears to be common in the forests of Senegal, and in those on the Blue Nile in Kordofan, and the White Nile in Sennaar. Its chief food consists of various kinds of insects; but it is stated that it will also eat the gum of various kinds of acacia, which we have already noticed as forming part of the diet of the baboons of the Sudan. Its habits are said to be similar to those of the other species.

In South Africa the Senegal galago is represented by a species so nearly allied to it that some writers have thought that the two forms are only varieties. This southern form is the Maholi galago (*G. maholi*), which is a distinctly inland species found as far south as Natal, and also met with in Nyasaland and the adjacent districts. A galago from the neighborhood of Titi, some distance up the Zambesi, has been identified with the Sennaar variety of the Senegal galago, but it would appear more probable that it is one of these. The prevailing color is brownish, or yellowish gray, becoming darker on the back, and still more so on the tail; while a broad streak on the nose, the cheeks, and the throat are white, and the inner surfaces of the limbs and the under parts are whitish, with a faint tinge of yellow. In the male specimen in the British Museum brought home by the late Sir Andrew Smith,—the original describer of this animal,—the fur surrounding the eyes is of the same color as that on the other parts of the head. In other examples in the national collection there are, however, dark rings round the eyes. This variability shows that we must not regard the presence or absence of such rings as indicating a specific distinction between the Senegal and Sennaar galagos.

DEMIDOFF'S GALAGO (*Galago demidoffi*)

The smallest and the last of these lemurs that we shall mention is Demidoff's galago, from the west coast of Africa. This animal differs from the two species just considered by its more slender and cylindrical tail and smaller ears. The length of the head and body is five inches, and that of the tail seven and one-half. The general color is brown, darker on the sides of the face; the white streak on the nose being narrow, and the chin, throat, and under parts of a reddish gray color. The so-called *G. murinus*, from Old Calabar, is probably identical with this species.

THE SLOW LEMURS, OR LORIS

Genera *Nycticebus* and *Loris*

With the slow lemurs of the warmer parts of Asia we come to the last group of the lemur family; this group likewise including the pottos of Africa, to be described next. The members of this group may be recognized either by the total absence of the tail, or by its length not exceeding one-third that of the head and body. The only lemur with which these animals could possibly be confounded would, therefore, be the indri of Madagascar; but, irrespective of its larger size, that animal is at once distinguished by the web uniting the bases of the toes, and the full development of the index finger of the hand. Moreover, the slow lemurs and the pottos may be further distinguished, not only from the indri, but likewise from all other lemurs, by the index finger of the hand being invariably very small, and even rudimentary and without any trace of a nail. Then, again, all these lemurs are peculiar in having the thumb of the hand and the great toe of the foot very widely separated from the other digits; this divergence being carried to such an extent in the case of the great toe, which is actually directed backward instead of forward.

Apart, therefore, from their distribution, there is no difficulty in distinguishing a slow lemur or a potto from all other lemurs. All the members of the present group have, however, the same number of teeth as the true lemurs, but they differ from the galagos and mouse-lemurs in that the bones of the upper part of the ankle are of ordinary proportions, so that the foot is not abnormally lengthened.

The slow lemurs are purely nocturnal, and are well known for the extreme slowness and deliberation of their movements; the latter characteristic having given their distinctive name to the Asiatic representatives of the group. It was probably their deliberate motions, nocturnal habits, and large glaring eyes, that suggested to the Swedish naturalist Linnæus the name of lemur for the group generally.

The slow lemurs are distinguished from the pottos by having a well-developed but small index finger on the hand, which has the usual three joints, and is provided with a distinct nail. They have no external tail, and are, as we have already mentioned, strictly confined to the tropical and subtropical regions of Asia. There are three species, all of which are very closely allied, although the majority of naturalists have considered it advisable to divide them into two genera, one of which contains two, and the other one species.

THE COMMON LORIS (*Nycticebus tardigradus*)

The common loris, or slow lemur, may be taken as the typical representative of the genus *Nycticebus*. The distinctive features of this animal, as the representative of a genus, are that the eyes are not of very enormous size, and are separated from one another by a considerable space; while the general build of the animal—more especially as regards its limbs—is comparatively stout.

The name loris, by which all the slow lemurs are commonly designated, is derived from the Dutch word *Loeris*, meaning a clown, and appears to have been applied to these animals by the Dutch colonists of the East Indian islands. To the natives of India the slow loris is known either by the name *Sharmindi billi*, "bashful cat," or *Lajjar banar*, "bashful monkey." It is an animal about the size of a cat; different individuals or races varying considerably in size, so that while some specimens do not measure more than thirteen inches in total length, others may reach as much as fifteen inches, or even more. Its proportions are thick and clumsy; the head being broad and flat, with a slightly projecting and pointed muzzle. The



THE COMMON LORIS.
(Two-fifths natural size.)

large eyes are perfectly circular, and their pupils can be completely closed by the gradual contraction of the iris, which opens from above and below, so that when the pupil is half concealed it takes the form of a transverse slit. The ears are short, rounded, and partly buried in the fur; and are, thus, very different from those of the galagos. The hind-limbs are only slightly longer than the others. With the exception of the muzzle, and the hands and feet, the whole of the body is covered with a thick coat of very close and somewhat long woolly fur.

There is a considerable amount of variation in the color of different local races of this species, although in all cases there is a dark stripe running down the middle of the back, sometimes extending to the head. In the more common and larger variety, the color of the fur is ashy gray above, tending to become silvery along the sides of the back, the under parts being lighter, and the rump often having a tinge of red. The stripe on the back is chestnut colored, and stops short at the hinder part of the crown of the head. The eyes are, however, surrounded by dark rims; between which is the white streak extending upwards from the nose. The ears, together with a small surrounding area, are brown.

In another, and generally smaller variety, the hue of the upper parts has a distinct tinge of red mingling with the gray; while the stripe on the back is wider, and often of a full brown color; but instead of stopping short at the back of the crown of the head, this band widens out into a large brown patch on the crown, which embraces the ears. The eyes, however, although surrounded by brown rings, are not connected with the patch on the head by a dark colored area. There is yet a third variety of this creature, found in Tenasserim, in which the general color is pale rufescent, while the dark stripe on the back, instead of expanding on the crown of the head, merely splits into a fork, of which each prong joins the dark ring round the eyes.

The slow loris is found over a large area in the countries lying to the eastward of the Bay of Bengal. It occurs on the northeast frontier of India in the provinces of Sylhet and Assam, whence it extends southward into Burma, Tenasserim, and the Malay Peninsula; while it is also found in Siam and Cochin-China, and the islands of Sumatra, Java, and Borneo.

Habits Its food consists of leaves and young shoots of trees, as well as fruits, various kinds of insects, birds and their eggs. It has been observed to stand nearly erect upon its feet, and from this advantageous position pounce upon an insect. It is generally silent, although sometimes uttering a low crackling sound; but when enraged, and especially if about to bite, it gives a kind of fierce growl. Mr. Blanford, quoting from notes by Colonel Tickell, observes that this animal is tolerably common in the Tenasserim provinces and Arakan; but being strictly nocturnal in its habits, is seldom seen. It inhabits the densest forests, and never by choice leaves the trees. Its movements are slow, but it climbs readily, and grasps with great tenacity. If placed on the ground, it can proceed, if frightened, in a wavering kind of trot, the limbs placed at right angles. It sleeps rolled up in a ball, its head and hands buried beneath its thighs, and wakes up at the dusk of evening to commence its nocturnal rambles. The female bears but one young at a time. Many accounts have been published of the habits of the slow loris in confinement. One of the best of the earlier of these is from the pen of Sir William Jones, who had one of these animals as a pet in Calcutta. All observers are agreed that, while these creatures are apt to be fierce when first captured, they soon become docile. They are very susceptible to cold, and when so affected are apt to be fractious and petulant.

There is an account of a tame loris in Loudon's *Magazine of Natural History*. After mentioning that the animal was especially fond of plantains, the writer

observes that it was also partial to small birds, which, "when put into his cage, he kills speedily; and plucking the feathers off with the skill of a poulterer, soon lodges the carcass in his stomach. He eats the bones as well as the flesh; and though birds, and mice perhaps, are his favorite food, he eats other meat very readily, especially when quite fresh; if boiled, or otherwise cooked, he will not taste it. He prefers veal to all other kinds of butcher's meat; eggs, also he is fond of, and sugar is especially grateful to his palate; he likewise eats gum arabic. As flesh is not always to be had quite fresh (the only state in which it is acceptable to him), he has for some time past been fed upon bread sopped in water and sprinkled with sugar; this he eats readily, and seems to relish much. . . . When food is presented to him, if hungry, he seizes it with both hands, and, letting go with his right, holds it with his left all the time he is eating. Frequently, when feeding, he grasps the bars in the upper part of his cage with his hind paws, and hangs inverted, appearing very much intent upon the food he holds in his left hand. He is exceedingly fond of oranges, but when they are at all hard, he seems very much puzzled how to extract the juice. I have, upon such an occasion, seen him lie all his length upon his back, in the bottom of the cage, and firmly grasping the piece of orange in both hands, squeeze the juice into his mouth. He generally sits upon his hind part (the hair of which is much worn by long sitting), close to the bars of his cage, grasping them firmly with his hind paws; he then rolls himself up like a ball, with his head on his breast, his thighs closely placed over his belly, and his arms over his head, generally grasping the bars of the cage with his hands also. In this position, and also without moving, he remains the whole day. Upon coming into the Channel, the cold weather affected him very much; he was seized with cramps, and I at that time placed him in a small box, which was filled with very soft down. This he felt so agreeable that, when cold, he never left it during the whole day, unless disturbed, and slept in it rolled up in the shape of a ball. He is extraordinarily slow in his motions, and his trivial name, *tardigradus*, well marks his habit in that particular. . . . When he climbs he first lays hold of the branch with one of his hands, and then with the other. When he has obtained a firm hold with both hands, he moves one of his hind paws, and, after firmly grasping the branch with it, he moves the other. He never quits his hold with his hind paws, until he has obtained a secure grasp with his hands. When he walks, he moves his limbs in the same methodical manner as when he climbs.

"His temper, in cold weather especially, is very quick; but, in general, he is rather timid, and never offers any injury unless incautiously touched, teased, or provoked; he then makes a shrill, plaintive cry, evidently expressive of much annoyance, and bites very sharply." He was obtained from the island of Penang, lying off the Malay Peninsula, and belonged to that variety in which the brown stripe of the back expands into a large triangular patch on the crown of the head.

The Javan loris (*N. javanicus*), said to be confined to the island from which it derives its name, is distinguished by having four brown bands running down the head and face from the crown, one band going to each eye, and one to each ear; the interspaces being pale, and the space between the eyes white. As Mr. Blanford remarks, this coloration is only one step in advance of that obtaining in the third

variety of the slow loris mentioned on p. 230, and it is therefore extremely doubtful whether the Javan loris really has any right to rank as a separate species.

THE SLENDER LORIS (*Loris gracilis*)

The slender loris, of which we give an illustration on this page, representing it asleep, and another on p. 233, is the sole species of the genus to which it belongs. It is distinguished from the slow loris by its lighter build of body and longer and more slender limbs, as well as by the greater size of the eyes, which are separated



THE SLENDER LORIS, IN WAKING AND SLEEPING POSTURE.

merely by a narrow space. The ears are also somewhat larger than in the slow loris.

The slender loris is a much smaller animal than the preceding species, the length of the head and body being about eight inches. In color it is a dark earthy gray, with a more or less marked ruddy tinge on the back and outer sides of the limbs, and showing a faint silvery wash; the under parts being much paler. Between the eyes there is the usual narrow white stripe, which spreads out on the forehead; and the cheeks and region round the eyes are darker than the rest of the body. Some young specimens are decidedly reddish.

This animal is confined to the forests of Southern India and Ceylon, and appears only to be found in those which are situated at but a comparatively slight elevation above the sea level. Mr. Blanford states that its habits are very similar to those of its cousin, the slow loris, although its movements are not quite so deliberate. It partakes of the same kind of food as the latter; and sleeps rolled up like a ball, with its head between its thighs, and its hand grasping the bough on which it is seated, as shown in our illustration on p. 232.

The present writer once had occasion to purchase a pair of these animals in the bazaar at Madras, and was surprised to find the number of specimens which were exposed there for sale. On the voyage up to Calcutta these pretty little creatures lived mainly on a diet of plantains and rice, supplemented with an occasional cock-



THE SLENDER LORIS.

roach; but as they passed the whole day in slumber, they could scarcely be reckoned as very lively pets.

Sir J. Emerson Tennent, who tells us that this animal has acquired the name of the "Ceylon sloth" in Ceylon, observes that "the singularly large and intense eyes of the loris have attracted the attention of the Singhalese, who capture the creature for the purpose of extracting them as charms and love-potions, and this they are said to effect by holding the little animal to the fire till the eyeballs burst. Its Tamil name is *Thavangu*, or 'thin bodied'; and hence a deformed child or emaciated person has acquired in the Tamil districts the same epithet. The light-colored variety of the loris in Ceylon has a spot on the forehead, somewhat resembling the *namam*, or mark worn by the worshipers of Vishnu; and from this peculiarity it is distinguished as the *Nama-thavangu*."

THE POTTOS, OR AFRICAN SLOW LEMURS

Genus *Perodicticus*

THE POTTO ASLEEP.
(One-half natural size.)

In West Africa the place of the slow lemurs of Asia is taken by two species of lemur, which may be collectively known as pottos, although in its proper application the native name *Potto* appears to be restricted to the first of the two kinds. The pottos are distinguished by the index finger of the hand being quite rudimentary, consisting only of a stump without distinct joints, and unprovided with a nail. The typical potto is further distinguished by possessing a short tail, but since this appendage is rudimentary in the second species, it does not afford any characteristics by which the African slow lemurs can be distinguished from their Asiatic relatives. The habits of the pottos are very similar to those of the *loris*, but their movements are still more deliberate and sluggish.

BOSMAN'S POTTO (*Perodicticus potto*)

The true, or Bosman's potto, represented in our first illustration in its sleeping posture, and in our second awake, takes its name from having been discovered by the Dutch navigator, Van Bosman, who met with it on the coast of Guinea, and described it as long ago as the year 1705, under its native name of *Potto*.

It is an animal of somewhat robust build, chiefly characterized by having a tail of about one-third the length of the head and body; the whole body being covered with a thick coat of soft and moderately long hair. The small and rounded ears stand up well above the fur of the head; the large eyes are separated from one another by a considerable interval; and the muzzle is rather broad and not very long. The arms and legs are nearly of equal length. With the exception of the nearly naked nose and chin, which are flesh colored, the general color of the animal is a kind of chestnut tint, with a black or grayish tinge; the throat and under parts being yellowish brown. The peculiar half-red, half-gray tint of the fur on the back is produced by the individual hairs being slate colored at their roots, reddish in the middle, and paler at the tips.

In addition to the loss of the index finger of the hand, the potto presents a curious peculiarity connected with the joints of the backbone in the neck. The spines, which project from the upper surfaces of their joints, are so elongated that they actually project beyond the general level of the skin of the back of the neck, where they form a series of little humps. We are at present unacquainted with the object of this peculiar structural arrangement.

Like the loris, the potto is nocturnal in its habits, sleeping during the whole of the day, as shown in our first illustration, rolled up in a ball, with the head between the fore-legs, and folded into the chest, and supporting itself in captivity by grasping the bars of its cage with both hands and feet.

The potto is found over a considerable extent of the west coast of Africa, having been recorded from Guinea, Sierra Leone, and the Gabun. Unfortunately,



BOSMAN'S POTTO.
(After Sclater, From *Proc. Zool. Soc.*)

however, we have but few details as to its habits in a wild state, this being probably largely due to the creature having been seldom seen by Europeans. Several specimens of the potto have been exhibited in the Gardens of the London Zoological Society; the animal is, however, extremely susceptible to cold, and requires the greatest care.

THE AWANTIBO (*Perodicticus calabarensis*)

Far more rare than the potto is the lemur represented in the illustration on the next page, which is known only from the regions around the Old Calabar river, flowing into the Bight of Biafra, east of the Niger. The awantibo is distinguished

from the potto, not only by its smaller size and more slender build, but also by the tail being reduced to a mere rudiment, and by a still further reduction of the index finger, which is represented merely by a little tubercle on the edge of the hand. Moreover, the other fingers of the hand, as well as the toes of the foot, with the exception of the first or great toe, have their first joints connected by folds of skin. The entire hands and feet are relatively smaller than in Bosman's potto. The color of the awantibo is yellowish brown above, but paler on the under parts, becoming whitish in places; and the whole length of the body is just over ten inches.



THE AWANTIBO.
(One-third natural size.)

This animal has only been known to Europeans since the year 1859. Very few specimens have been received in this country—none of them in a living condition; and we have practically no information regarding its habits. It has been observed that in this animal and the potto the hands and feet are divided into two distinct moieties by the separation of the thumb and great toe from the other digits; this being most marked in the hand by the loss of the index finger. The hands and feet may accordingly be compared to the feet of a parrot; and it is suggested by the

writer, who makes this comparison, that in both cases the structure is one specially adapted for long-continued grasping without change of position.

FOSSIL LEMURS

We have already incidentally referred to the occurrence of several fossil lemurs in the lower Tertiary strata of Europe; but it remains to be mentioned that other species have been found in the corresponding rocks of North America. This is a very curious and highly important circumstance, since it suggests that while the New World monkeys and marmosets, which have very lemur-like molar teeth, may have taken their origin directly from the extinct lemurs of that hemisphere, the Old World monkeys may have had an independent origin from the ancient lemurs of Europe.

Curiously enough, although the remains of lemurs have been known for very many years from the lower Tertiary rocks, both of Hampshire and France, it is only quite recently that they have been recognized as such, having been long regarded as belonging to small hoofed Mammals. One of these groups of lemurs, represented by several species of different, though relatively small, dimensions, occurring both in England and France, has been described under the name of *Microchoerus*; the term meaning "small pig," and having been applied from the supposed affinity of the creature to the hoofed Mammals. These animals were undoubtedly lemurs nearly allied to living forms, their skulls being very like those of the galagos, although their upper premolar teeth more nearly resembled those of the mouse-lemurs. Like all other fossil lemurs, they are, however, distinguished from living forms by the circumstance that the place and form of the lower tusk is not taken by the first of the lower premolar teeth (see p. 203). This is a very important circumstance, since it shows that these ancient lemurs were what zoologists call less specialized than their living relations, and also removes any difficulty as to the descent of monkeys (in which the lower tusk always remains) from lemurs.

Another and larger European Tertiary lemur, known as the *Adapis*, carries the series one step still further back, since it has four premolar teeth on either side of each jaw; whereas, as we have seen, no living lemur has more than three of these teeth. Here, then, so far as it goes, we have decisive evidence of the approximation of the extinct lemurs to the inferior orders of Mammals, among which four premolar teeth are frequently present; and we may thus hope in time to discover further evidence of intermediate forms.

Some of the extinct North American lemurs, with four premolars, do indeed exhibit certain transitional characteristics; but it would be beyond the province of the present work to enter upon their discussion.

We have already called attention at some length to the importance of these extinct European lemurs as helping to explain the peculiar distribution of their modern relatives; and we may take leave of the subject by mentioning that their occurrence in France and England during the early part of the Tertiary period indicates the prevalence in these countries of a tropical or subtropical climate.



THE LEFT UPPER CHEEK-TEETH
OF AN EXTINCT EUROPEAN
LEMUROID (*Adapis*).



THE TARSIER.
(One-half natural size.)

CHAPTER VIII

APES, MONKEYS, AND LEMURS—*concluded*

THE TARSIER AND THE AYE-AYE

THESE two strange creatures, although sufficiently nearly related to the lemurs to be included in the same great group, yet differ so markedly, not only from the lemurs, but likewise from each other, as to make it necessary to refer them to two distinct families—*Tarsiidæ* and *Chiromyidæ*. This gives us, for the first time, instances of families represented, not only by a single genus, but by a single species.

THE TARSIER (*Tarsius spectrum*)

Takes the first of its Latin names from the elongation of the bones of the upper part of the ankle (*tarsus*), after the manner we have noticed as occurring in the mouse-lemurs and galagos, and its second from its spectre-like and ghostly appearance. It is a native of various islands in the Malayan region, being found, among others, in Celebes, Sumatra, Borneo, the Philippines, and some others. It has never, we believe, been exhibited alive in this country, and since accounts at first hand from those who have seen animals in their native countries are always valuable, we commence our notice of this animal by quoting from Dr. Guillemard, who received a living specimen while at Celebes, and, in his *Cruise of the Marchesa*, writes as follows: "The most interesting addition to our menagerie was a tiny lemuroid animal (*T. spectrum*), brought to us by a native, by whom it was said to have been caught upon the mainland. These little creatures, which are of arboreal and nocturnal habits, are about the size of a small rat, and are covered with remarkably thick fur, which is very soft. The tail is long, and covered with hair at the root and tip, while the middle portion of it is nearly bare. The eyes are enormous, and indeed seem, together with the equally large ears, to constitute the greater part of the face, for the jaw and nose are very small, and the latter is set on, like that of a pug dog, almost at a right angle. The hind limb at once attracts attention from the great length of the tarsal [ankle] bones, and the hand is equally noticeable for its length, the curious claws with which it is provided, and the extraordinary disc-shaped palps on the palmar surface of the fingers, which probably enable the animal to retain its hold in almost any position. This weird-looking creature we were unable to keep long in captivity, for we could not get it to eat the cockroaches which were almost the only food with which we could supply it. It remained still by day in its darkened cage, but at night, especially if disturbed, it would spring vertically upwards in an odd mechanical manner, not unlike the hopping of a flea. On the third day it found a grave in a pickle-bottle."

If we add that the general color of the fur is usually some shade of brownish fawn, with the face and forehead reddish, and a dark ring round the enormous eyes, the above account gives a very good idea of the general appearance of the tarsier,* the length of whose body is about six inches. This account does not, however, show us any reasons why this animal should be separated from the typical lemurs as the representative of a separate family; and we must therefore proceed to the consideration of this point.

Now, the elongation of the bones of the upper half of the ankle evidently allies the tarsier to the galagos and mouse-lemurs; and if the other characteristics of the animal approximated to them, there would be no reason why it should not be included in the family. It happens, however, that there are very important differences connected with the teeth, and it is on these zoologists largely rely in assigning the tarsier to a distinct family. In describing the teeth of the lemurs it has

*In Dr. Guillemard's figure, reproduced on p. 245, the ears are longer than in our heading.

been shown that the middle pair of incisors in the upper jaw are separated from one another by an intervening space, and it may be added here that they are of small size. If, however, we examine the skull of a tarsier, we shall find that these central upper incisors are, as in ourselves, of large size, and placed quite close to one another. Then, again, we shall find that the upper tusk is much smaller than in the typical lemurs. Moreover, if we examine the lower jaw, we shall see that the tusk is formed by the canine tooth, instead of being the most anterior of the premolars; the latter tooth being smaller than either of the other two premolars, instead of taking the form and function of a tusk, as in the true lemurs. In having but a single pair of lower incisors, which an examination of its skull would show to be the case, the tarsier agrees with the indri lemur; but in the presence of three premolars on either side of each jaw, it resembles the true lemurs. Its whole series of teeth are thirty-four in number—four more than in the indri, and two less than in the true lemurs, and may be expressed by the formula $i \frac{2}{1}$, $c \frac{1}{1}$, $p \frac{3}{3}$, $m \frac{3}{3}$.

It is, therefore, clear that the tarsier differs very markedly from ordinary lemurs; and, if our observations made under the head of fossil lemurs have been understood, it will be apparent that in this respect the tarsier is what zoologists term a more generalized form than the true lemurs, and that it closely resembles the extinct types. Indeed, the series of teeth in the extinct microchoere are expressed by the same formula as the one denoting those of the tarsier. We may, therefore, venture to conclude that this animal shows in its teeth signs of affinity with the extinct European lemurs, which have been lost in the true lemurs and their allies. In regard to the elongation of the bones of the upper half of the ankle, the tarsier is, however, evidently a specialized, or highly modified creature; and it is probable that the same structural peculiarity did not exist in the Eocene lemurs.

Another peculiarity of the tarsier is that the two bones of the lower leg,—the tibia and fibula,—instead of being quite separate from one another, as in all other lemurs, are united in their lower half. Then again, in place of only the toe next the great toe being furnished with a sharp compressed claw, and all the other toes having flat nails, the middle toe is also provided with a similar compressed and pointed claw.

We might refer to certain features connected with the structure of the skull of the tarsier, and also mention some peculiarities in the anatomy of its soft parts; but sufficient has been said to show what a very remarkable creature it is when properly studied, and to indicate why it is referred to as a distinct family. It is, indeed, generalized, or little modified in regard to its teeth, but highly specialized, or much modified in respect of the bony skeleton of its legs and feet.

Dr. Guillemard calls special attention to the peculiar leaps made by his captive tarsier; and this habit of leaping is highly characteristic of the species,—as we have seen it to be of the galagos and mouse-lemurs, in which the ankle bones are modified in the same manner, although to a less degree. The tarsier is described as progressing in the woods by a series of leaps from bough to bough, or along a single bough; and it doubtless makes use of similar leaps to pounce upon its living prey. Its food consists chiefly of insects and small reptiles, and it does not appear that it ever touches fruits. Tarsiers are rare in their native lands, and instead of going in

small parties are found singly or in pairs. They are looked upon with great dread and horror by the native inhabitants of the Malayan islands. According to the late Mr. Cumming, who once had a female and young tarsier alive, the animal is known to the natives of the above-mentioned islands by the name of the Malmag. The same writer also informs us that only one young is produced at a birth; and that when the natives capture one of a pair, they are sure of securing its fellow. When feeding, the tarsier sits up on its hind-quarters and holds its food in its hands, somewhat after the fashion of a squirrel.

THE AYE-AYE (*Chiromys madagascariensis*)

The last of the lemur-like animals, and, at the same time, of the whole order of Primates, is the aye-aye of Madagascar, which has teeth so utterly different from all other members of the order that it was long considered to belong to the Rodent order (rats, rabbits, etc.).

The most peculiar feature about the teeth of the fully adult aye-aye is that the front, or incisor teeth, are reduced to a single pair in each jaw, which are curved, and have their extremities brought to a sharp chisel-like edge, admirably adapted for gnawing and rasping hard substances. The structure of these teeth is in fact precisely the same as in the front teeth of rats and beavers; their sharp, cutting-edge being produced by the circumstance that while the body of the tooth is formed of the comparatively soft ivory, the front surface is faced with a layer of hard, flinty enamel. And it will be obvious that the result of wear in a tooth of this type will be to produce a chisel-like edge. It will further be apparent that such a tooth, if continually employed in rasping away hard substances, would be very quickly worn away altogether, if it were of the same length as ordinary teeth, and not provided with some kind of renewal. This difficulty is obviated by the front teeth of the aye-aye remaining open at their lower ends, and undergoing a continual process of growth; so that as their summits are worn away they are pushed further up from below. In all these points their teeth are precisely similar to those of the Rodent Mammals. A further resemblance to Rodents is shown by the absence of tusks in the aye-aye; and also by the cheek-teeth being separated by a long gap from the incisors, as well as by being reduced in number, and having their crowns with nearly flat surfaces, instead of being surmounted with the sharp cusps found in those of the true lemur. Indeed, the total number of teeth in the adult aye-aye is only eighteen; these being expressed by the formula $i_1^1, c_0^0, p_0^1, m_3^3$, or exactly the same as in many Rodents.

If, then, the teeth of the adult aye-aye are so exactly like those of a Rodent, the reader may well ask why it is not placed among the rats and beavers, instead of among the lemurs. To this it may be replied that in the young aye-aye the milk- or baby-teeth are very much more like those of the true lemurs; while the anatomy of the skeleton and the soft parts is essentially that of a lemur, and not that of a Rodent. The resemblance of the skull and teeth of the aye-aye to those of a Rodent, is, indeed, an excellent instance of what zoologists term an *adaptive* or *parallel resemblance*. When two animals belonging to totally different groups have

more or less nearly similar habits, it frequently results that they will closely resemble one another in at least some part of their structure; such particular structure being the one best adapted for a particular mode of life. In all such cases a superficial examination of the animals in question will frequently lead to their being referred to one and the same group; while further minute investigations will reveal the fact that their deep-seated internal structure—which alone reveals their true affinities—is very different. Such was the case with the aye-aye, which was at first referred to the Rodents; its affinities to the lemurs not having been discovered till a fuller examination.

The aye-aye agrees with the true lemurs in having the great toe of the foot furnished with a flattened nail, and capable of being opposed to the other toes;



THE AYE-AYE.
(One-ninth natural size.)

this feature being alone sufficient to prove that the creature has nothing to do with the Rodents. With the exception of this great toe, however, all the toes and fingers, which are very long and narrow, are furnished with narrow and sharply-pointed claws. Although both the hands and the feet are large in proportion to the size of the animal, yet the great peculiarity is concentrated in the hands, in which the fingers are much longer than are the toes of the feet. One finger—namely, that corresponding to our middle finger—is more remarkable than the others, being of great length and extreme slenderness. It is probable that this ghostly middle finger is employed in extracting from their burrows the larvæ

which, as we shall shortly learn, appear to form a portion of the creature's natural diet.

In size the aye-aye may be compared to a cat; its total length being about three feet, of which the larger moiety is formed by the bushy tail. The comparison with a cat may be further extended to the short and rounded head and cat-like face of the animal. The rounded ears are, however, relatively larger than those of a cat, and have the peculiarity of being nearly naked. The fur is long, and composed of a mixture of longer stiffish hairs, with an under-coat of more bushy and shorter ones. The prevailing color is dark brown, tending to black; the throat being yellowish gray, and the under parts showing a rufous tinge. Some of the longer hairs on the back are whitish, thus producing a somewhat mottled appearance in the fur.

The aye-aye was discovered by the French traveler Sonnerat—who likewise first obtained the indri—as far back as the year 1780; and it was described in the first year of the present century by Baron Cuvier, who regarded it as a kind of squirrel. Nothing more was heard of the creature from Sonnerat's time till 1860, when specimens were sent to this country, and described by Sir Richard Owen. The following account of the habits of the aye-aye in its native land was published in 1882 by Mr. L. Baron, a missionary in Madagascar. "The aye-aye," writes Mr. Baron, "lives in the dense parts of the great forest that runs along the eastern border of the central plateau of the island, but only in that part of it which separates the Sihanaka province from that of the Betsimisaraka, and which is about twenty-five miles from the east coast, in latitude $17^{\circ} 22''$ S., or thereabouts. Possibly there are other parts of the country where the aye-aye is found; but so far as my knowledge extends (and I have made inquiries in different parts of the island), this is the only region where the creature finds its home. . . . From what I have gathered from the natives, it seems to be pretty common, its nocturnal habits, and the superstitious awe with which it is regarded (and of which I shall speak presently), accounting for its apparent rarity.

"The native name of the animal is Haihay (Hihi); but this is not derived from the exclamations of surprise which the natives exhibited at the sight of an unknown animal, but is simply onomatopœtic, the creature's call being *haihay haihay*. The animal, as is well known, is nocturnal in its habits, prowling about in pairs—male and female. It has but one young at a birth. It builds a nest about two feet in diameter, of twigs and dried leaves, in the dense foliage of the upper branches of trees. In this it spends the day in sleep. The nest is entered by a hole at the side. The teeth are used in scratching away the bark of trees in search of insects, and the long claw in digging out the prey when found. A white insect called *Andraitra* (possibly the larva of some beetle), seems to form its chief food. I was told that it frequently taps the bark with its fore-feet, and then listens for the movement of its prey beneath, thus saving itself useless labor. It does not flee at the sight of man, showing that for generations it has not been molested by him; which is indeed true, as the following will show. The natives have a superstitious fear of the creature, believing that it possesses some supernatural power by which it can destroy those who seek to capture it or to do it harm. The consequence of this is that it is with the greatest difficulty one can obtain a specimen. With most of

the people, no amount of money would be a sufficient inducement to go in pursuit of the creature, 'because,' say they, 'we value our own lives more than money.' It is only a few of the more daring spirits among them, who knowing the *odiny*, that is the secret by which they can disarm it of its dreaded power, have the courage to attempt its capture. Occasionally it is brought to Tamatave for sale, where it realizes a good sum. Now and then it is accidentally caught in the traps which the natives set for lemurs; but the owner of the trap, unless one of those versed in the aye-aye mysteries, who know the charm by which to counteract its evil power, smears fat over it, thus securing its forgiveness and good-will, and sets it free."

Another account was published in the following year by the Rev. G. A. Shaw, also a resident in Madagascar, and since it differs somewhat from the preceding, which it supplements in some other respects, it may be likewise quoted. Mr. Shaw starts by stating, in opposition to Mr. Baron, that the name of the creature is derived from *hay! hay!* the Malagasy exclamation of surprise; the animal being known to the natives as the Haikay (pronounced Hayekaye). Be its origin what it may, there is thus full testimony that the name by which we know the creature is substantially the same as that by which it is known in its native land.

"Being a nocturnal animal," Mr. Shaw continues, "it is very difficult to get any reliable information concerning its habits in the wild state, and native reports are altogether contradictory with respect to these matters. Even with reference to its natural food, no satisfactory explanation can be obtained from the people. Many assert positively that it lives on honey; but one I had in captivity would not eat honey in any form, either strained or in the comb, or mixed with various things I thought he might have a fancy for. Others say it lives on fruits and leaves; others that birds and eggs are its natural food. I fancy from what I saw of my captive that both these conjectures are nearer the truth; for after a few days, during which it would eat nothing, and it was thought that the proper food had not been offered (but it was in reality pining or sulking), it took several fruits which I was able to procure for it. It liked bananas; but it made sorry efforts at eating them, its teeth being so placed that its mouth was clogged with them. The small fruits of various native shrubs it also devoured, as also rice boiled in milk and sweetened with sugar; but meat, larvæ, moths, beetles, and eggs it would not touch. But I noticed that when I came near its cage with a light, it almost invariably started and went for a little distance in chase of the shadows of the pieces of bananas attached to the wire-work in front of its cage; and I think that if I could have procured some small birds it would have, if not devoured them, at any rate killed them for their blood, as some lemurs are known to do. It drank water occasionally, but in such a way as to make it highly probable that it does not drink from streams or pools in the ordinary way. It did not hold its food in its hands as the lemurs which I have had in captivity have done, but merely used its hands to steady it on the bottom of the cage. But whenever it had eaten, although it did not always clean its hands, it invariably drew each of its long claws through its mouth, as though, in the natural state, these had taken a chief part in procuring its food.

"In some accounts, given by different writers, the haikay is said to be easily tamed, and to be inoffensive. . . . In each of these qualities, I have found, both

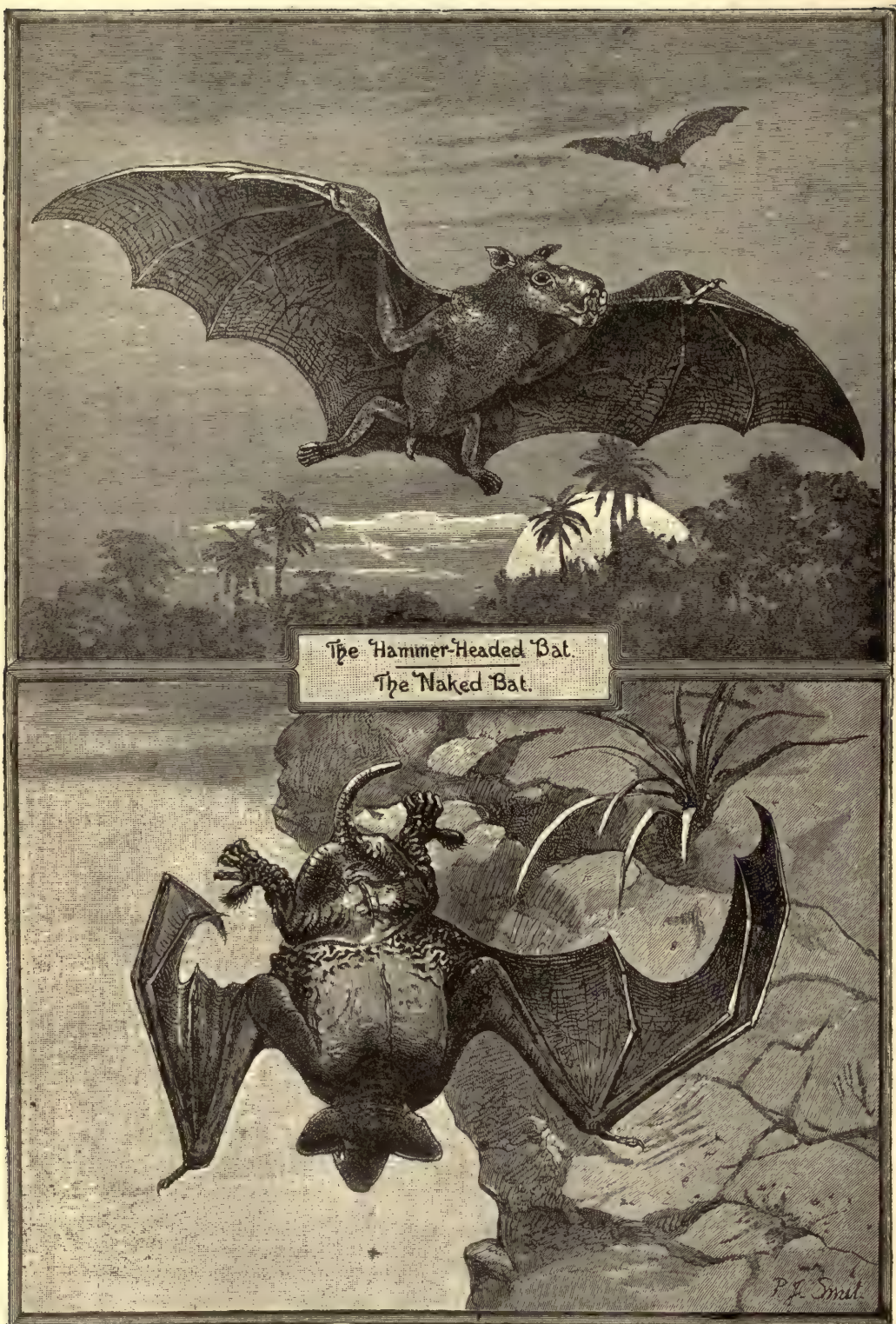
from native accounts, and from the specimen I have kept, that exactly the reverse is the case. It is very savage, and, when attacking, strikes with its hands with anything but a slow movement. As might be imagined in a nocturnal animal, its movements in the daytime are slow and uncertain; and it may be said to be inoffensive then. When it bit at the wire netting in the front of its cage, I noticed that each of the pair of incisors in either jaw would separate sufficiently to admit the thick wire even down to the gum, the tips of the teeth then standing a considerable distance apart, leading to the supposition that, by some arrangement of the sockets of the teeth, they could be moved so far without breaking. The haikay brings forth one at a birth, in which the long claw is fully developed."

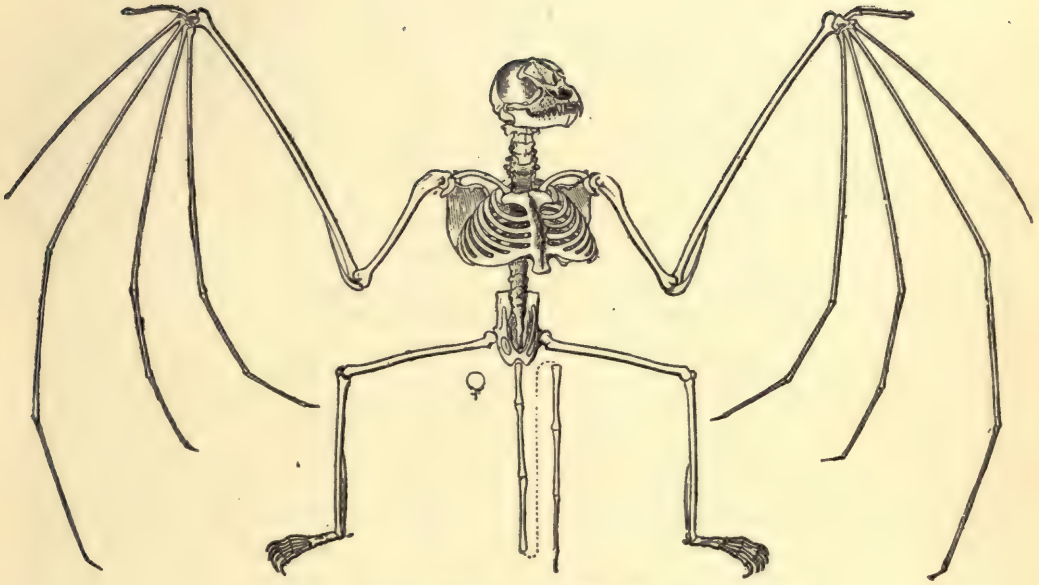


THE TARSIER ACCORDING TO GUILLEMARD.

(From *The Cruise of the Marchesa*.)

It has been observed that captive aye-ayes are very partial to the juice of the sugar-cane, which they obtain by ripping up the canes with their front teeth; and since sugar-cane grows wild in Madagascar, we may infer that its juice forms a part of the food of these animals in their wild state. It is, therefore, probable that the diet of the aye-aye is a mixed one, consisting partly of grubs, partly of the juices of plants, partly of fruit; but whether birds or their eggs also form a part of the bill of fare must be left for future observers to determine. The favorite haunts of these animals appear to be the bamboo-brakes, which form such a large portion of the forest in some regions of the island.





SKELETON OF BAT (*Nycteris*).

CHAPTER IX

BATS—ORDER CHIROPTERA

IN SOME cases there is more or less difficulty, especially when we have to take extinct types into consideration, in finding well-marked characteristics by which the various orders of Mammals can be distinguished from each other. With bats, however, there is no such difficulty, since they are sharply distinguished from all other Mammals by possessing the power of true flight, for the purpose of which their fore-limbs are specially modified. We say true flight advisedly, for the reason that there is a kind of spurious flight possessed by certain other Mammals, such as flying squirrels and flying phalangers, which is quite different from the flight of bats, and does not entail any special modification of the structure of the fore-limbs. True flight, like that of birds and bats, is effected by means of alternate upward and downward strokes of the wings, and can be carried on as long as the muscular power of the flyer permits. Spurious flight like that of the flying squirrels, is, on the other hand, nothing more than a prolongation of an upward or downward leap, by the aid of parachute-like expansions of the skin of the sides of the body, and

cannot be extended in an upward direction beyond the limits of the impetus of the original leap.

This power of true flight is, then, the essential characteristic of all bats; and it is a very remarkable fact that among all the host of extinct animals with which we are now acquainted, none have been discovered in any way connecting bats with other Mammals. Indeed, remains of bats very closely resembling existing kinds are met with in the upper part of the Eocene period, which show that the order is a very ancient one, and that we should have to go back still earlier before creatures intermediate between bats and other Mammals were met with. In spite of this, naturalists have, however, no hesitation in believing that bats have taken origin from Mammals of ordinary terrestrial habits. It is found, indeed, that in their essential structure bats are so closely allied to the Insectivores (of which we treat next), such as shrews, moles, etc., that there can be little doubt of their derivation from the ancestral forms of that order; and it is probable that the power of true flight was developed gradually from spurious flight, like that of flying squirrels. Moreover, it will be shown latter on that there is a very curious kind of Insectivore, endued with the power of spurious flight, which may give us some inkling of the manner in which bats have been derived from the earlier members of that order of Mammals. Bats are accordingly regarded by zoologists as neither more nor less than Insectivores, specially modified and adapted for an aerial life. Moreover, as there appear to be indications that the Insectivores were connected with some of the extinct lemurs, it is now considered best to place them and the bats immediately after the Primates. This must not, however, be taken as any indication that these groups really occupy a high position in the zoological scale; the fact really being that their organization is of a low type, and far inferior to that of the Carnivores which are placed later on.

**Character-
istics**

The most obvious and important characteristic of bats being their faculty of flight, and the apparatus for this being mainly furnished by the fore-limb, the order to which they belong has been appropriately named Chiroptera, or hand-winged. In the great majority of Mammals the hind-limbs are as large as, or larger than, the front pair, but in bats the latter (as is well shown in the figure of the skeleton at the head of this chapter) vastly exceed the former in length. In a bat's wing the humerus of the upper arm, is only moderately elongated, but the single complete bone in the fore-arm, corresponding to the human radius, has a far greater length, and this extraordinary elongation is carried to a still greater extent in the bones of the hand, all of which, with the exception of those of the thumb, form long slender rods. The thumb is free, and terminates in a hooked claw, which can be used for the purpose of climbing or suspension; but the fingers, of which the third is the longest, are connected together by the delicate membrane constituting the soft part of the wing. This wing membrane is continued along the arm and the sides of the body, and thence to the hind-legs. There is, moreover, a similar membrane connecting the two hind-limbs with the generally long tail; this membrane being usually supported by a peculiar spur of bone projecting from the foot. The toes are, however, quite free. In consequence of the connection of the hind-limb with the wing membrane, the

knee joint is directed backwards instead of forwards in the usual manner; and this peculiar arrangement renders a bat's movement on the ground an awkward kind of shuffle.

In order to afford space for the attachment of the powerful muscles necessary to move the wings, the chest of bats, like that of birds, is remarkably large. But as these animals are poor walkers, the haunch-bones are relatively small and weak.

Teeth The great majority of bats feed solely on insects, and have their cheek-teeth furnished with a number of sharp cusps, admirably adapted for holding and piercing the tough integuments of beetles and many other insects. A few bats, however, are bloodsuckers, and these have the front teeth specially modified for piercing the skin of the animals they select as their victims. Others, and among them the largest representatives of the order, are fruit eaters; and these accordingly have a quite different kind of cheek-teeth, in which the crowns are nearly smooth, and without cusps.

The number of the different teeth in different bats is variable, and is of great importance in distinguishing the different genera; but as some of these teeth may be exceedingly minute, their enumeration requires great care. No bat, it may be observed, has more than two pairs of incisor teeth in the upper jaw; neither are there ever more than three premolars on each side of the upper and lower jaws, so that the number of teeth behind the tusks, or canines, never exceeds six.

So thoroughly are bats adapted for a life in the air, that most of them but seldom resort to the ground, and even when they do so they generally endeavor to leave it as soon as possible by ascending a tree, rock, or wall, whence they either again take flight, or settle themselves into their favorite position of repose, suspended head downward by the feet. Not only do most bats feed and drink while on the wing, but the females even carry their young tightly clinging to their bodies.

Sense of Touch In their active life bats being mostly crepuscular or nocturnal, while their eyes are relatively small, it is obvious that they must be provided with some special means of avoiding contact with objects during flight. This appears to be effected by the extreme development of a sense more or less akin to our sense of touch, by which the neighborhood of objects is perceived without actual contact; and it was demonstrated as long ago as 1793, by the cruel experiment of depriving bats of sight and then allowing them to fly in a room across which silken threads were stretched in such a manner as to leave just sufficient space for them to pass between with outstretched wings. The unfortunate bats not only succeeded in passing between these threads without contact, and likewise avoided the walls and ceiling of the room, but, when the threads were placed still nearer together, they contracted their wings in order to be able to pass without contact. In the same manner they flew between branches and twigs of trees placed in their course, and suspended themselves when tired of flight on the walls of the room, just as easily as when they enjoyed the use of their eyes. In the great majority of bats it appears that this sense of touch is situated in the wing membranes, and in the delicate and frequently enormously elongated ears, which are often provided with a kind of secondary inner ear, known as the tragus. There are, moreover, certain bats provided with an additional organ of perception, which takes the form of

expansions of skin from the nose and adjacent parts of the face, forming what is generally known as the "nose-leaf." These folds of skin may be either comparatively small and simple, or so large as to form a kind of mask, communicating a most extraordinary physiognomy to the bats in which they occur. The various membranes forming these nose-leaves are always fringed with long and fine hairs, which evidently correspond to the "whiskers" of the cat; and we may accordingly regard these nose-leaves merely as an excessive development of the cat's whiskers, accompanied by leaf-like growths from the skin of the nose. It has been observed by Dr. Dobson—our great authority on bats—that those species which are without nose-leaves are in the habit of flying at dawn or twilight, while the leaf-nosed kinds are more strictly nocturnal, and are thus much less frequently shot when on the wing. The fruit-eating bats, whose habits are very different from the other members of the order, never have these nose-leaves, and their ears are small and unprovided with a tragus; there being no necessity for the extreme delicacy of tactile perception required in the other groups.

Cry When on the wing, the ordinary insectivorous bats utter a short, sharp squeak of such an extremely high pitch that to many persons it is quite inaudible, although to others, whose ears are attuned to the reception of such high-pitched tones, these cries are of piercing intensity.

Migrations The insect-eating species of bats inhabiting the temperate regions, being dependent for their nourishment upon a full supply of insects, must in winter either migrate to warmer regions, or hibernate. In our own country all the species hibernate, and do not appear to migrate at all; and it is probable that this hibernating habit also holds good for the whole of the European bats. It seems, however, that at least one North American species—the *Vespertilio borealis*—migrates to a certain extent during the summer, not visiting the more northerly portions of its habitat till August, when the long intense twilights, which would be unsuitable to its habits, have ceased. In Canada, moreover, Dr. Hart Merriam is of opinion that at least two species of bats regularly perform extensive migrations in order to avoid the intense cold of the northern winter. This eloquent writer observes that "all North American bats, except when their habits have been modified by proximity to man, may be classed as *cave-dwelling* or *tree-dwelling*, according to the places in which they spend the day. As a rule, the cave-dwelling species live in large colonies, while the tree-dwelling live singly or in small companies. Now, it is well known that the temperature in caves, even in high latitudes, is little affected by the external atmosphere, but remains nearly uniform throughout the year; while in holes in trees the temperature is about the same as that of the surrounding air. Hence, animals inhabiting caves can pass the winter much farther north than species living in hollow trees. The hoary bat (*Atalapha cinerea*) is a tree-dwelling species, and its home is in the Canadian fauna, from the Adirondack mountains northward. Therefore, on purely theoretical grounds, it should be expected to migrate." Now, specimens of this bat have been not unfrequently observed in the autumn and winter from localities so far to the southward of its usual habitat, that there would seem to be no longer any reasonable doubt as to its being truly migratory. It has, indeed, been found as far away from

its ordinary summer haunts as the Bermudas, where Mr. J. M. Jones states that it is observed occasionally at dusk during the autumn months hawking about according to its nature in search of insects; but as it is never seen except at that particular season, it is clear that it is not a resident, but merely blown across the ocean by those violent northwest gales which also usually bring numbers of birds from the American continent. The hoary bat is, however, not the only species in which there is evidence of periodical migrations. Thus Dr. Merriam tells us that the silver-haired bat (*Vesperugo noctivagans*), which ranges as far north as Hudson's Bay, is known to visit every spring and autumn a solitary lighthouse situated on a solitary rock off the coast of Maine, fifteen miles from the nearest island and thirty miles from the mainland. This rock being uninhabited permanently by bats, the occurrence of these stray individuals in the spring and fall seems to afford perfectly conclusive evidence of the migratory habits of the particular species to which they belong.

Distribution In regard to their geographical distribution, it may be observed that bats are found over almost the whole world; one species at least even extending as far northward as the Arctic circle. They are far more abundant within the tropics and the warmer parts of the temperate zones than elsewhere; and it is to those regions alone that the larger species are restricted. Indeed, the bats, according to Mr. Wallace, may be regarded as some of the most characteristic of the Mammals of the tropical zone, occupying in this respect a position second only to that held by the apes, monkeys, and lemurs, and becoming suddenly much less plentiful, both as regards the number of individuals and of species, when we pass into the temperate zone, and still more reduced in both respects when we reach the colder parts of those regions.

In some instances particular family groups of bats are confined more or less exclusively to particular regions of the earth's surface; although others enjoy an almost world-wide distribution. For instance, while the fruit-bats are entirely confined to the warmer regions of the Old World, and the vampires and their allies to America, some of the more common types of ordinary European bats, like *Vesperugo* and *Vespertilio*, are almost cosmopolitan. It will be found that these cosmopolitan forms belong to the more generalized types, while those restricted to particular districts are usually the more specialized form. It is somewhat curious that, according to Dr. Dobson, bats are quite unknown in Iceland, St. Helena, Kerguelen, and the Galapagos islands.

Numbers The number of species of bats known to science is now enormous.

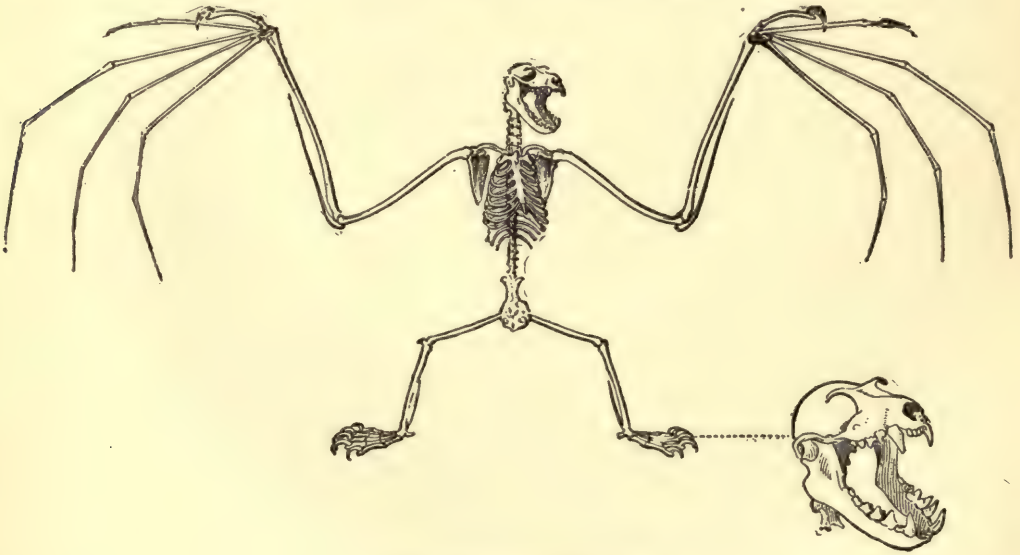
In a list published in 1878, Dr. Dobson recognized no less than four hundred distinct species, arranged in eighty genera, and six families. Since that date the number has, however, been so largely increased, that we shall probably be not far wrong in setting it down as but little, if at all, short of four hundred and fifty. With such a portentous list to deal with, it will be obvious that, in a work like the present, all that can be attempted is to indicate some of the more generally interesting and leading types, leaving the others for technical treatises. The old English name Flittermouse, by which these animals were known to our ancestors, and by which they are still designated in certain parts of the country, conveys a

very accurate notion of their zoological position, if we use the term mouse in the popular signification, in which it embraces animals like the shrews, as well as the true mice.

THE FRUIT-BATS

Family *PTEROPODIDÆ*

The largest of all bats are the so-called flying foxes, or fruit-bats, of the warmer regions of the Old World, which differ from the other members of the order in their purely frugivorous habits, and in certain details of structure partly caused by adaptation to their special mode of life. It is highly probable, as Professor T. Bell observes, that some of these huge fruit-bats "with their predatory habits, their multitudinous numbers, their obscure and mysterious retreats, and the strange combination of beast and bird which they were believed to possess, gave to Virgil the



SKELETON OF FRUIT-BAT.
(One-tenth natural size.)

idea, which he has so poetically worked out, of the harpies which fell upon the hastily-spread tables of his hero and his companions, and polluted, whilst they devour, the feast from which they had driven the affrighted guests."

Since the fruit-bats differ so essentially from all the other members of the order, both in habits and structure, they are not only referred by naturalists to a separate family,—the *Pteropodidæ*,—but are likewise distinguished as a special suborder, appropriately termed the *Megachiroptera*, or large bats.

As a group, the fruit-bats are characterized by their generally large size, and by the peculiar nature of their teeth, as well as by certain features connected with the wings, ears, and tail. As regards the teeth, they are characterized by the

molars having nearly, or quite smooth crowns, elongated from back to front, and divided by a deep longitudinal groove; such a type of tooth being obviously as admirably adapted for mashing up pulpy fruits, as the cusped teeth of ordinary bats would be unsuited. The wings of fruit-bats may be at once distinguished from those of all other kinds by having three (instead of one or rarely two) joints in the second or index finger, as shown in our figure of the skeleton; but the metacarpal bones, or those between the wrist and the fingers, must not be confounded with the proper bones of the latter. Moreover, the terminal joint of the second finger is generally provided with a claw; whereas in other bats the thumb alone is thus furnished. Then, again, a fruit-bat may always be distinguished by its ears, of which the sides of the projecting portion, or *conch*, are united at the base so as to form a complete ring; the ears, as we have already incidentally mentioned, being invariably of small size, and unprovided with an inner tragus. The last distinctive feature of the group that it will be necessary to mention here is that the tail, if present at all, is always short, and is situated beneath the membrane between the hind legs, with which membrane it may have no connection. There are certain other characteristics of the group which require a considerable amount of anatomical knowledge for their due appreciation, and which we accordingly pass over.

Many considerations lead to the conclusion that the fruit-bats are a specialized group, which have been derived by adaptation from ordinary insectivorous bats; and this view has been remarkably confirmed by the comparatively recent discovery of a peculiar species, which, while agreeing with the rest in the general structure of its molar teeth, differs in that these teeth retain cusps representing those of the insect-eating group.

THE COMMON FRUIT-BATS, OR FOX-BATS

Genus *Pteropus*

The best known of the group are the so-called fox-bats, or flying-foxes, taking their name from their long fox-like faces, of which a group is represented in the colored plate, and a single example in the illustration on the next page. These bats, constituting the genus *Pteropus* of naturalists, are characterized by their large size, the presence of thirty-four teeth (among which there are two pairs of incisors and three premolars in each jaw), the total absence of a tail, the long and fox-like muzzle, and the thick coat of woolly fur with which the neck is covered.

Fox-bats are found in India, Ceylon, Burma, the Malay Archipelago, the Seychelles, Madagascar, the Comoro islands, the south of Japan, and most of the islands of the Pacific (the Sandwich and some other groups excepted), as well as in Papua and Australia. Curiously enough, they are quite unknown in Africa, although common in the



HEAD OF WALLACE'S FOX-BAT.
(From Gray, *Proc. Zool. Soc.*)

Comoro islands, two hundred miles distant. Probably the best known of all the species is the Indian fox-bat (*Pteropus medius*), characterized by its naked and sharply-pointed ears. All who have resided in India are familiar with the long strings of fox-bats which may be seen, as the shades of evening approach, wending their way from their sleeping-places to the scene of their nocturnal depredations. Writing of these bats, the late Dr. Jerdon says that



THE KALONG, OR MALAY FOX-BAT.
(One-third natural size.)

“during the day they roost on trees, generally in large colonies, many hundreds often occupying a single tree, to which they invariably resort if not driven away. Toward sunset they begin to get restless, move about along the branches, and by ones and twos fly off for their nightly rounds. If water is at hand, a tank, or a river, or the sea, they fly cautiously down and touch the water, but I could not ascertain if they took a sip, or merely dipped part of their bodies in. They fly vast

distances occasionally to such trees as happen to be in fruit." As the first streaks of dawn begin to appear in the east, the bats set out on their homeward journey from the field of their depredations, and the scene which ensues on their arrival at their roosting-place is graphically described by Colonel Tickell: "From the arrival of the first comer, until the sun is high above the horizon, a scene of incessant wrangling and contention is enacted among them, as each endeavors to secure a higher and better place, or to eject a neighbor from too close vicinage. In these struggles the bats hook themselves along the branches, scrambling about hand-over-hand with some speed, biting each other severely, striking out with the long claw of the thumb, shrieking and cackling without intermission. Each new animal is compelled to fly several times round the tree, being threatened from all points, and when he eventually hooks on he has to go through a series of combats, and be probably ejected two or three times before he makes good his tenure."

Full accounts of this bat will also be found in Sir J. Emerson Tennent's *Natural History of Ceylon*, although it is probable that this writer was mistaken in saying that its diet included insects. He observes that a favorite resort of these bats was some tall india-rubber trees near Kandy, in Ceylon, where they used to assemble in such prodigious numbers that large boughs would not unfrequently give way beneath the accumulated weight of the flock. It is also stated that the branches on which they are accustomed to roost become almost denuded of leaves, most of these being stripped off by the bats as they contend with one another for the favorite roosting-places. When suspended in the usual position, these bats move easily from place to place, and from branch to branch, by using each foot in turn, and by climbing, when occasion requires, by the aid of the claws. When feeding, Colonel Tickell states that the fox-bats hang by one foot only, and take the fruit they are about to eat in the other, seizing it by driving in their claws like a fork, and not by a grasping action.

Fox-bats invariably fly singly in long files, and never in close flocks; their flight being a slow, flapping, measured movement. In Calcutta the long strings of these bats may be seen every evening stretching across the sky from west to east, although the number of individuals varies considerably at different seasons of the year. Writing there on August 23d, 1869, Dr. John Anderson observes that "this species has been flying for the last few days from the north to the south of the city, in immense numbers, immediately after sunset. The sky from east to west has been covered with them as far as the eye could reach, and all were flying with an evident purpose, and making for some common feeding-ground. Over a transverse area of two hundred and fifty yards, as many as seventy bats passed overhead in one minute, and as they were spread over an area of great breadth, and could be detected in the sky on both sides as far as the eye could reach, their numbers were very great, but yet they continued to pass overhead for about half an hour. This is not the first time I have observed this habit in this species; indeed, it was much more markedly seen in August, 1864, while I was residing in the Botanical Gardens, Calcutta. The sky, immediately after sunset, was covered with these bats, traveling in a steady manner from west to east, and spread over a vast expanse, all evidently making for one common goal, and traveling as it were, like birds of passage with

a steady purpose. I observed them, not only on one, but on both sides of the river. But in the Botanical Gardens I noticed that, whilst the great mass of bats passed on, a few were attracted by trees then in fruit, and seemed to go no further. This continued for a number of successive nights, but I did not observe the bats returning." What occasioned these enormous assemblages has not yet been explained.

This species of fruit-bat has an expanse of wing of about four feet from tip to tip; and it is found throughout the whole of India, Ceylon, and Burma. In the Andaman and Nicobar islands in the Bay of Bengal, it is, however, replaced by a species (*P. nicobaricus*) of nearly the same dimensions, but readily distinguished by its rounded ears.

The largest of all fox-bats, and consequently of all bats, is, however, the kalong or Malay fox-bat (*P. edulis*), represented in the figure on p. 254, which measures upwards of five feet from tip to tip of the wings, and derives its name from its flesh being eaten by the Malays, as, indeed, is that of its Indian cousin by some of the natives of that country. Writing of the Malay species, Mr. Wallace states that they are considered a great delicacy by the natives, and are much sought after. "At about the beginning of the year they come [to Batchian] in large flocks to eat fruit, and congregate, during the day, on some islands in the bay, hanging by thousands on the trees, especially on the dead ones. They can then be easily caught or knocked down with sticks, and are brought home in basketfuls. They require to be carefully prepared, as the skin and fur have a rank and powerful foxy odor; but they are generally cooked with abundance of spices and condiments, and are really very good eating,—something like hare."

Of the Australian fruit-bat (*P. poliocephalus*) the late Professor Moseley describes a roosting-place which he visited in New South Wales in the following words: "In a dense piece of bush, consisting principally of young trees, the trees were hung all over with these bats, looking like great black fruits. As we approached, the bats showed signs of uneasiness, and after the first shot were rather difficult to approach, moving from before us, and pitching in a fresh tree some distance ahead. The bats uttered a curious cackling sound when disturbed. They were in enormous numbers, and although thousands had been shot not long before by a large party got together for the purpose, their numbers were not perceptibly reduced. They do great harm to the fruit orchards about Parramatta, and the fruit-growers there organize parties to shoot them."

The same observer also records that certain species of fruit-bats, which he met with in the Friendly islands and in New South Wales, are in the habit of devouring flowers as well as fruits. The particular species observed in the Friendly islands was doubtless the Polynesian fruit-bat (*P. kerandrenii*), which is found in most of the islands in that region. "These bats," writes Professor Moseley, "appear on the wing in the early afternoon in full sunlight, and at the time of our visit were feeding on the bright red flowers of one of the indigenous trees. Flowers form an important proportion of the food of fruit-bats. In New South Wales, in Botany bay, in May, numbers of fruit-bats were to be seen feeding on the flowers of the gum trees. The bats most probably often act as fertilizers by carrying pollen from tree to tree adherent to their fur. As dark comes on the fruit-bats become more



FRUIT-BATS.

plentiful. It is probably only those specially driven by hunger that come out before dark." These observations show that two of these bats are, at certain seasons, in the habit of supplementing the ordinary fruit-diet by one of flowers; but it does not appear that a similar habit has been recorded in the case of the Indian or Malayan species. It has, however, been observed that the Indian fruit-bat will greedily drink palm-juice from the pots hung on the trees for the purpose of collecting it; and individuals have been found lying at the foot of the trees in a helplessly intoxicated condition.

THE TAILED FOX-BATS

Genus *Xantharpyia*

Closely allied to the common fox-bats are the tailed fox-bats, which are represented by a comparatively small number of species, ranging from India, Burma, and the Malayan islands to the Persian Gulf, Palestine, Africa, and Madagascar. They are distinguished from all the members of the genus *Pteropus* by the presence of a short tail, which is connected with the membrane between the legs, and likewise by their inferior size and less brilliant coloration, as well as by the fur on the back of the neck being no longer than that on the body. The collared tailed fox-bat (*X. collaris*) is represented in the accompanying illustration.

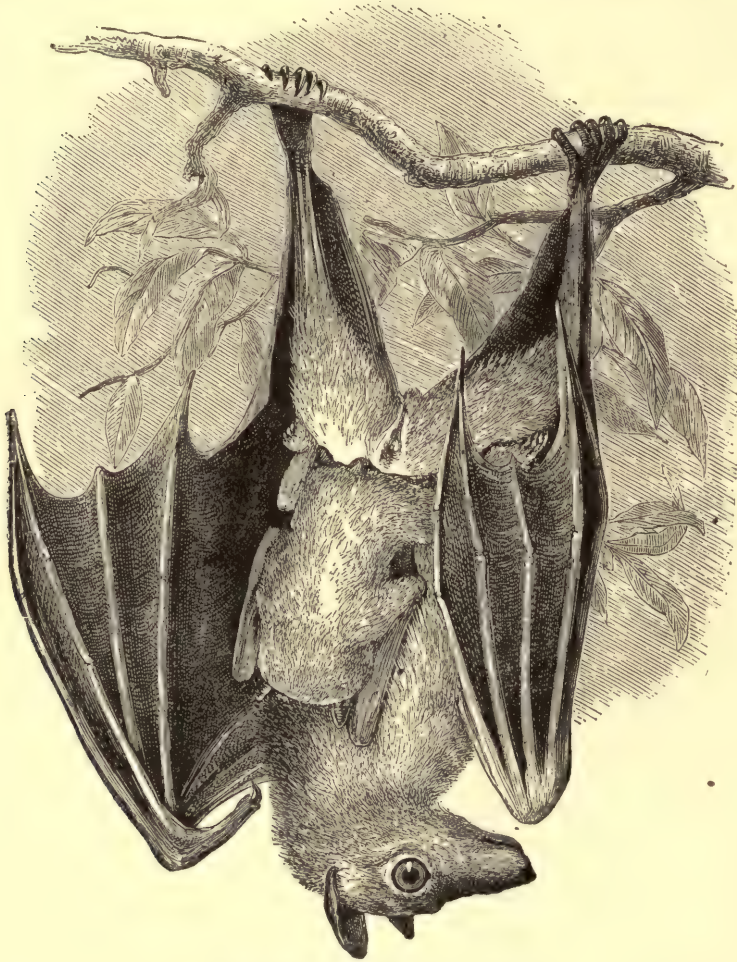
Many of these fox-bats, instead of living in trees, inhabit caves or deserted buildings; one species being found in numbers in the chambers of the Great Pyramid in Egypt, as well as in old buildings in Palestine; while a second was observed by Mr. Blanford inhabiting caves excavated in rock salt in Kishm island, in the Persian gulf. Dr. Dobson is of opinion that different individuals of a single species of these bats may inhabit either caves or trees; and he further believes that those dwelling in caves may be distinguished from those habitually frequenting trees by their shorter fur. Like most other members of the family, these bats will travel long distances in their daily journeys for food; and it was at one time supposed that in Nipal they flew between thirty and forty miles out and home. This enormous distance has, however, been shown to be incorrect; the length of the daily journey really being about sixteen miles each way.

THE EPAULETTED FRUIT-BATS

Genus *Epomophorus*

A striking contrast to the neat and sharp-muzzled heads of the fox-bats is presented by a small group of African species known as the epauletted fruit-bats, so named from the tufts of hair surmounting the shoulders of the males. These bats have fewer teeth than the fox-bats, the total number being only twenty-six or twenty-eight. They are readily distinguished by their remarkably large and

long heads, with a bluntly conical or truncated muzzle, the very large, flabby, and expansible lips bordering the capacious mouth, and also by the presence of a tuft of white hair on the margins of the ears. Some of these bats are tailless, while others have a short tail unconnected with the membrane between the legs. In all the species but one, the males, which are larger than the females, are furnished with peculiar pouches of skin on the sides of the neck, from the interior



COLLARED FOX-BAT AND YOUNG.
(After Sclater, From the *Proc. Zool. Soc.*)

of which project tufts of long yellowish hair, surmounting the shoulders, so as to resemble epaulettes, and thus giving origin to the popular and scientific names of the group.

These bats are confined to that portion of Africa lying to the south of the Sahara desert, which constitutes the greater portion of the Ethiopian region of zoologists, and are unknown in Madagascar. They are most abundant in the forest

regions of the western side of the continent, especially the Gabun district. It is here that we meet with that most remarkable species discovered by Du Chaillu, known as the hammer-headed bat (*Epomophorus monstrosus*), which differs from the rest in the absence of shoulder-tufts in the males. The head in that sex has an enormous muzzle, furnished with a kind of shield-like expansion in front, communicating a most repulsive and hideous expression to the whole face, which reminds one of a very ugly caricature of the head of a mule. Sir John Kirk tells us that the epauletted fruit-bats subsist largely on figs, and Dr. Dobson remarks that their voluminous and capacious lips are admirably adapted to retain and swallow without loss the juicy contents of these and other soft fruits during the process of mastication.

THE SHORT-NOSED FRUIT-BATS

Genus *Cynopterus*

The short-nosed fruit-bats comprise several species almost exclusively confined to the Oriental region (that is to say, ranging from India to the Malayan islands), and readily distinguished from the fox-bats by their short and rounded muzzles, marked by a shallow vertical groove, and their small size. The teeth are, moreover, somewhat less numerous than in the latter, being usually thirty-two, but occasionally, owing to the absence of one pair of lower incisors, only thirty. They have generally a short tail, with the same relations to the membrane between the legs as in the tailed fox-bats.

The common short-nosed fruit-bat (*Cynopterus marginatus*), ranging from India to the Philippine islands, is one of the best-known forms, and is remarkable for its extreme voracity. It is very common throughout India, where it generally inhabits trees,—especially the palmyra palm,—but is occasionally found in caverns and crevices of rocks. This bat is very destructive to fruit, being especially fond of plantains and mangoes. As an instance of its voracity, it may be mentioned that an individual, of which the weight when killed some hours after the feast was only one ounce, consumed two and a half ounces of plantains within a period of three hours. It has been observed that the flight of this species is much lighter than that of the fox-bats, although the general habits of the two groups are very similar.

THE TUBE-NOSED FRUIT-BATS

Genus *Harpyia*

Two curious bats, differing from one another considerably in size, and found from Celebes to New Guinea, North Australia, and New Ireland, are distinguished from the short-nosed fruit-bats by their still shorter and more rounded muzzles, but more especially by the production of the nostrils into a pair of long diverging

tubes, reaching rather beyond the extremity of the muzzle. Such a structure, except to a less degree in one group of insect-eating bats, is quite unparalleled



HEAD OF TUBE-NOSED FRUIT-BAT.
(From Dobson, *Proc. Zool. Soc.*, 1877.)

elsewhere in the whole class of Mammals, and gives to the creatures such an extraordinary appearance that it is difficult to believe at first sight that it is natural. So far as we are aware, no suggestion has been yet made as to the probable reason for this tubular prolongation of the nostrils, although it is, doubtless, of some special advantage to these bats, of whose habits we have, indeed, practically no information. The tube-nosed fruit-bats are further distinguished by

the small number of their teeth, of which the total is only twenty-four.

THE CUSPED-TOOTHED FRUIT-BAT

Genus *Pteralopex*

In our brief survey of the fruit-bats we must not omit mention of a rather large species recently discovered in the Solomon islands, which is remarkable for the peculiar structure of its teeth. This bat, which is of a uniform dark-brown color, has the general external characteristics of the fox-bats, with which it also agrees in the number of its teeth, but the muzzle is much shorter and thicker. The peculiarity of the teeth is that the molars have a series of cusps, almost obliterating the longitudinal grooving characteristic of those of all the fruit-bats. The presence of these cusps clearly shows that the cusped-toothed fruit-bat is the descendant of a connecting form between the insect-eating bats and the fox-bats; and it is upon the evidence of this species that naturalists now regard all the fruit-bats as derived from bats with fully cusped teeth like those of the insectivorous species. The Solomon islands form a group lying to the east of New Guinea, and extending in a southeasterly direction from New Ireland; and it is just such remote spots as these which appear to be the most favorable for the survival of ancient connecting types of animals like the species under consideration.

THE LONG-TONGUED FRUIT-BATS

Genus *Carponycteris*, etc.

All the fruit-bats hitherto noticed are characterized by the tongue being of moderate dimensions, and the well-developed molar teeth. We come now, however, to a small group comprising seven genera (each represented by only a single species), all of which are distinguished by their long and slender tongues, terminating in re-

curved papillæ, and likewise by their exceedingly narrow molar teeth, which scarcely project above the level of the gums. All of these bats have long and sharply-pointed faces. With the exception of one West African species, the long-tongued fruit-bats are confined to the Indian, Malayan, and Australian regions, extending from India itself to New Guinea and the Solomon islands, and they are found on the continent



RED-NECKED FRUIT-BAT.

of Australia. They are of relatively-small size as compared with the fox-bats. The use of the long tongues of these bats is unknown, but since they can be protruded some distance in advance of the muzzle, it may be that they are employed to lick out the contents of soft fruits while still hanging on the trees; this being confirmed by the small size of the molar teeth, which can be of but little service for mastication.

The small long-tongued fruit-bat (*Carponycteris minima*) is the smallest of all the fruit-bats, being considerably inferior in size to the European noctule described in the next chapter. It has a very extensive geographical distribution, ranging from Northern India and Burma to Australia and New Ireland. It is common in the warm valleys of Sikhim; and according to Mr. Blanford, generally roosts in trees, although occasionally found in old buildings. It lives on fruits of all kinds, of which it consumes, in proportion to its size, a large quantity. The cavern long-tongued fruit-bat (*Eonycteris spelæa*) is rather a larger species, distinguished by the absence of a claw on the index finger. It inhabits caves in Burma, Java, and Cambodia. The only other species we shall mention is Woodford's long-tongued fruit-bat (*Nesonycteris woodfordi*), from the Solomon islands, which is remarkable for its brilliant coloration, the body and hairy portions of the limbs being of a bright orange, while the wing membranes are dark brown. Nothing seems to be known of the habits of this bat.

CHAPTER X

BATS—*continued*

THE INSECT-EATING BATS (*MICROCHIROPTERA*)

HAVING treated in the preceding chapter of the bats which feed entirely upon fruit or flowers, we now come to the consideration of the much larger group of those which subsist upon insects, among which we must include a few which have acquired frugivorous habits, and likewise those which subsist by sucking the blood of Mammals larger than themselves. As being generally of much smaller size than those of the frugivorous group (*Megachiroptera*), the members of the insectivorous group of bats are collectively known to zoologists as the *Microchiroptera*; and it remains to indicate the leading characteristics (apart from those of an anatomical nature) by which this group may be distinguished from the one treated in the preceding chapter.

Apart from their generally inferior bodily size, the insectivorous bats are broadly distinguished from the fruit-bats by the presence of a number of sharp cusps on the crowns of their molar teeth; these cusps in the upper molars taking the form of the letter W. There is, moreover, no trace of the longitudinal groove found in the molars of the fruit-bats; the upper molars having their longer diameter placed transversely, instead of longitudinally. Another distinctive feature is to be found in the index finger of the fore-limb, which has never more than two joints, and usually contains but one; moreover, this finger never terminates in a claw, as it so frequently does among the fruit-bats. Then, again, the head of an insect-eating bat, may be at once recognized by the two margins of the conch of the ear arising from the head from separate points, instead of forming a complete ring at the base, as in the fruit-bats. Moreover, the tail, which is very generally present and of considerable length, is either contained in the membrane joining the hind-limbs, or is visible upon the upper surface of the same. The insect-eating bats are further divisible into two minor sections, distinguished from one another by several easily recognized features. In the first section one of the chief characteristics is that the tail is included within the membrane between the hind legs. Another is that the inner pair of incisor teeth in the upper jaw are never very large, and are always separated from one another in the middle line by a considerable space. Yet another characteristic of these bats, with the exception of three species (belonging to as many genera), is that the third, or middle, finger has only two bony joints; to which it may be added that when the animals are at rest it will be found that the first joint of the same finger is invariably extended in the same line as its supporting metacarpal bone.

THE HORSESHOE AND LEAF-NOSED BATS

Family RHINOLOPHIDÆ

The bat represented in the accompanying illustration is one of the two British representatives of a well-marked and rather numerous family distributed over the greater part of the Old World. This family is technically known as the *Rhinolophidæ*, and includes the horseshoe-bats (*Rhinolophus*) and the leaf-nosed bats (*Hipposiderus*), together with some less important genera. All of them are charac-



THE GREATER HORSESHOE-BAT.
(Four-fifths natural size.)

terized by having a well-developed nose-leaf completely surrounding the nostrils, which are situated in a depression of the snout. And they are also distinguished by their large ears, which have no trace of an inner ear, or tragus, and are in most cases completely separate from one another at their origin at the head.

The horseshoe-bats (*Rhinolophus*), of which our figure is an example, always have 32 teeth, of which the incisors number $\frac{1}{2}$, and the cheek-teeth $\frac{5}{8}$ on either side; and they are further distinguished by the shape of the nose-leaf, which con-

sists of two portions, the one immediately over the nose being horseshoe shaped, and the posterior one pointed. Moreover, the ears have a large process of membrane in front, termed the *antitragus*.

The greater horseshoe-bat has a very wide distribution, being found over a large portion of Europe, the greater part of Africa, and Asia northward of the Himalaya mountains, and as far eastward as Japan. In England, although nowhere common, it is met with in the southern countries, and is occasionally found in the Midlands, but is quite unknown further north, and has never been observed in Ireland. Like the other species, it generally prefers to rest during the day in caves and old buildings, and does not issue forth till late in the evening, when it continues its flight till dark. As we have already mentioned, there seems little doubt that the nose-leaf of these bats is especially intended to aid them in avoiding obstacles during flight, as most or all of the species fly later than the bats which are unprovided with these appendages. Mr. J. E. Harting states that this species (*Rhinolophus ferrum-equinum*) when on the wing appears as large as the noctule, from which it may be distinguished by the greater proportionate width of the wing membrane. In the caves of the department of the Eure, in the north of France, great numbers of these bats collect for their winter sleep; upwards of one hundred and eighty having been observed in one colony, and eighty in another. It is further noteworthy that these colonies always consist exclusively of either males or females.

The second British representative is the lesser horseshoe-bat (*R. hipposiderus*), which ranges over a large part of Europe, extending as far north as the Baltic. It has been recorded from Ireland, and is also found at Gilgit, on the northwest portion of India, though in Africa it does not extend south of the Sahara. Mr. Blanford states that during the day it hides in caves, ruined buildings, outhouses, etc., often in large numbers. It usually appears about dusk, and, according to Scully, by whom it was observed in Gilgit, has a powerful and long-sustained flight; but Blasius, who made his observations on European examples, says its flight is rather irregular and fluttering. It is generally found rather higher in the air than *R. ferrum-equinum*, and is more frequently found away from dense tree growth.



HEAD OF LEAF-NOSED BAT
(*Hipposiderus calcaratus*).
(From Dobson, *Proc. Zool. Soc.*, 1877.)

The largest of all the species is the great eastern horseshoe-bat (*R. luctus*), which is found in elevated districts from India to Borneo and the Philippine islands. It has a very large and peculiar nose-leaf, the anterior part of which spreads over the lips; and the color of the fur and wings is generally jet black. According to Captain Hutton, these bats generally go in pairs, instead of in flocks, although several pairs may not unfrequently be found in large caves. The same observer states that this species commences its flight early in the evening, and flies at a height of about twenty or thirty feet above the ground, its movements being somewhat heavy and slow. There are many other species of horseshoe-bats among which there is one (*R. megaphyllus*) peculiar to Northeast Australia, a second (*R. capensis*) confined to South Africa, extending as far north as Zanzibar, and a third (*R.*

æthiops) from West Africa. In the colder regions all the species of *Rhinolophus* hibernate; but the late Dr. Leith Adams mentions that in Malta the little horseshoe-bat, which on the continent retires for the whole winter, may be observed at any season, although of course most plentiful in summer, even in midwinter occasionally venturing forth at twilight when the warm southern winds are blowing. The horseshoe-bats, with their near allies, the leaf-nosed bats, may be regarded as the most highly organized of the entire insectivorous group, as is especially indicated by the great development of their nasal appendages and also by their compact and delicately-formed bones.

The leaf-nosed bats (*Hipposiderus*) may be distinguished from the preceding group by the form of the nose-leaf, in which the upper and hinder portion does not terminate in a point, and there is also no median process hiding the nostrils. Moreover, the large leaf-like antitragus found in front of the ears of the horseshoe-bats is reduced to a very small remnant; and the teeth, owing to a reduction in the number of the premolars, are fewer than in the horseshoe-bats, the total being either twenty-eight or thirty. Leaf-nosed bats are quite unknown in Europe, but are widely spread over the warmer regions of Africa, Asia, and Australia. Some of these bats exceed in size the largest of the horseshoe group; the largest of all being Commerson's bat (*H. commersoni*), from Africa and Madagascar, next to which is the great Himalayan leaf-nosed bat (*H. armiger*), extending from the Eastern Himalayas to China. Males of this species are just over four inches in length, exclusive of the tail. The following account of its habits is taken from Dr. J. Scully, who writes: "This bat usually harbors during the day in caves, or commonly in lofts, outhouses, and sheds that are little used; in the latter localities it suspends itself, by the claws of the feet, from the rafters. When attaching itself in this way to the edge of a beam or rafter, the animal sways, pendulum-like, a few times until the impetus given during flight is exhausted; and it then hangs motionless with its wings folded close to the body. If slightly alarmed by the opening of a door, or any unusual noise in the room it occupies, the head is thrust out and turned carefully in various directions, as if for the purpose of finding out the cause of disturbance. On such occasions I have purposely dropped a heavy book on the floor so as to alarm the bat thoroughly. The animal would at once fly off, and either take several turns round the room or else leave it; but it invariably returned quickly and attached itself to the spot it had previously occupied. It comes out for the capture of its prey about sunset, and its hunting-grounds are gardens, orchards, cleared spaces in woods, or avenues of trees; somewhere near trees always. It is sometimes found flying on a level with the tops of the trees, but more commonly nearer the ground; a very characteristic movement it has is a slow but steady sweep round a leafy tree, or clump of trees, in search of insects which frequent the lower branches. While it was intently occupied in this circular flight I have been nearly touched on the face by this bat, as I walked across the grounds attached to my house in Nipal. And in passing so close to one it could be distinctly heard crunching the hard-bodied insects it had caught between its strong teeth. Sometimes these bats come out of their day retreat before the insects they are in search of are to be found in plenty. On the twenty-fifth of August, about 6 P. M., I noticed an ex-

ample flying close to a tree. It circled twice round the tree while I was watching it, keeping about three feet above the ground. Apparently finding that none of the insects it wanted were about, it suspended itself to a small horizontal branch of the tree, just three and a half feet above the ground, and so remained for some time. It was probably waiting for a more propitious hour. Whether this was really the explanation of the pause in its flight or not, it seems certain that this bat does not ordinarily remain very long on the wing. I have often observed that in the early part of the night it alternated its pursuit of insects with short periods of repose in an outhouse. On one occasion, I observed a bat of this species return three times during the evening (from about 8 to 10 P. M.) to a room I happened to be occupying; and, curiously enough, it always attached itself to precisely the same part of the ceiling. That part of the room, however, was the point furthest away from me, and my presence may have influenced the bat in its selection of the spot."

In addition to the true leaf-nosed bats, of which there are fully twenty species, there are several more or less closely allied kinds which are referred by zoologists to distinct genera. The only one of these we shall notice here is the flower-nosed bat (*Anthops ornatus*), discovered a few years ago in the Solomon islands, and remarkable for the extraordinary development of its nose-leaf. This appendage assumes the form of a large rosette, covering the whole front of the face, reaching from eye to eye, and extending downward nearly to the upper lip. Above the eyes the upper border of this rosette terminates in three stalked balls, while the remainder consists of overlapping furbelow-like expansions of skin; the obliquely-placed nostrils appearing somewhat below its centre. It is difficult to believe that such an extraordinary structure is solely connected with the sense of touch, and we should rather assume that in this case the great development of the rosette is to a considerable extent an ornamental feature. Mr. O. Thomas remarks that the discovery of such a form in the Solomon group is a most interesting and unexpected fact, since oceanic islands are generally characterized by the large proportion and great specialty of their frugivorous as compared with their insectivorous bats, a rule otherwise well exemplified in this archipelago.



FACE OF THE FLOWER-NOSED BAT.

(Four times natural size.)

(After Thomas, *Proc. Zool. Soc.*, 1888.)

THE FALSE VAMPIRE BATS AND THEIR ALLIES

Family NYCTERIDÆ

Certain bats agreeing with the preceding group in the possession of a nose-leaf, and found in the tropical and subtropical parts of Africa, India, and the Malayan

region, are (from the blood-sucking propensities of at least one of the species) commonly known as vampires; but since that term is exceedingly likely to lead to confusion with the true American vampires, they are better designated false vampires. The five species of these bats, together with seven of another genus, collectively constitute a distinct family.

All the members of this family, which is known as the *Nycteridæ*, are distinguished from the horseshoe-bats and their allies by the presence of a large tragus in the long ears, and also by the smaller development or practical absence of the nose-leaf. The false vampires (*Megaderma*) are easily recognized by their enormous ears being united together for a longer or shorter distance by their inner margins, and also by the divided tragus and tall nose-leaf. Their tail is so small as to be practically invisible; and they have no upper incisor teeth; the total number of their teeth being 24 or 26, of which the incisors number $\frac{6}{2}$, the canines $\frac{1}{1}$, and the cheek-teeth either $\frac{8}{8}$ or $\frac{4}{4}$ on each side. One of the best known species of the group is the Indian false vampire (*M. lyra*), which is found throughout India, from Kashmir to Ceylon, and, although at present unrecorded from Burma, reappears in China. Decisive evidence of its blood-sucking propensities was obtained by Blyth, who on one occasion saw one of these bats fly into his house with a smaller bat in its mouth, which it dropped when pursued. The captured bat was weak from loss of blood, and when put next morning into a cage with its captor was at once attacked by



HEAD OF INDIAN FALSE VAMPIRE
BAT.

the latter, being seized behind the ear and speedily devoured. Canaries in Rangoon have also been killed by bats, probably belonging to this species—an inference which, if correct, proves the occurrence of this bat in Burma. Blyth was also informed by a correspondent that his house was frequented by numbers of these bats, and that in the morning the floor of the veranda was strewn with the débris of slaughtered frogs, large grasshoppers, and crickets; while on one occasion the remains of a small fish were discovered. Frogs appeared, however, to be the favorite food of these bats, which could sometimes be heard crunching the bones and skulls of their victims. In correspondence with their different

habits, the jaws, and lips of this species, as well as of the other false vampires, differ considerably from those of ordinary insect-eating bats; and we may hence assume that all the species partake more or less extensively of an abnormal diet. The large Indian false vampire, which, like the other species, has no tail visible externally, measures from three to three and a half inches in length, while its extended wings have a span of from fourteen to nineteen inches.

A second species, the Malay false vampire, extends from the Malayan region and Tenasserim to China, while two others are found in Africa. One of the latter (*M. frons*) is characterized by the great height of the nose-leaf, and also by the length of the tragus of the ear. It is an inhabitant of the west coast. These African species have one more upper premolar tooth than the Oriental forms.

There does not appear to be any popular name for the bats forming the second genus—*Nycteris*—of this family. They are readily distinguished from the false vampires by the practical absence of a distinct nose-leaf, which is represented only by a slit running down the middle of the face from the nostrils to the line of the ears, on the sides of which are small expansions of skin. Then, again, the ears, although furnished with an undivided tragus, are merely joined by a very narrow band at their bases, which in some species is so slightly developed as to be almost invisible. Moreover, these bats have well-developed tails, and also upper incisor teeth, the total number being 32, of which $\frac{2}{3}$ on each side are incisors, $\frac{1}{3}$ canines, and $\frac{1}{3}$ cheek-teeth. So different, indeed, are the bats of the genus *Nycteris* from the false vampires, that the reader might well wonder why the two are associated in a single family. There are, however, important resemblances in the form and structure of the head and skull, among which—as characteristics visible externally—may be mentioned the pointed and cylindrical muzzle, and the projection of the lower jaw beyond the upper; these being sufficient to establish the near relationship of the two groups.

With the exception of one species (*N. javanica*) from Java and the Malay Peninsula, the bats of this genus are confined to Africa, where they are mostly restricted to the regions south of the Sahara, although one of them ranges into Egypt.

THE TYPICAL BATS

Family *VESPERTILIONIDÆ*

With the exception of the horseshoe-bats already described, the whole of the bats found in the British Islands, and, indeed, in Europe generally, may be included in a single family, which may conveniently be designated popularly as the typical bats, and is scientifically known as the *Vespertilionidæ*. All these bats agree with the two preceding families in the relation of the tail to the membrane between the legs; but they are distinguished by the absence of a distinct nose-leaf, the nostrils merely forming circular or crescent-shaped apertures at the end of the muzzle without any complications from foldings of the skin. Their tails are long, and produced to the edge of the membrane between the legs; and their ears are always furnished with a distinct tragus. Apart from certain details in the structure of their skulls which need not be mentioned here, it may be observed that the incisor teeth of the upper jaw are always of small size, those of opposite sides being separated from one another by a considerable interval, while their number varies from one to two pairs. The lower incisor teeth, on the other hand, are, with one exception, three pairs. Moreover, there are generally either six or five cheek-teeth on each side of both upper and lower jaws, the reduction in number in the latter instance being due to the disappearance of one of the premolars.

In addition to being the common bats of Europe, the typical bats have an almost world-wide distribution, and include more than one hundred and fifty distinct species. The absence of the nose-leaf, together with other features in their organ-

ization, indicates that they are less specialized types than the two preceding families, to which, however, they are in other respects intimately related. Accordingly, Dr. Dobson considers that in the typical bats we have the descendants of the ancestral forms which gave rise both to the *Nycteridæ* and the horseshoe and leaf-nosed bats; and we may thus regard all these three families as forming a single distinct branch of the insectivorous bats; the main stem of this branch being formed by the *Vespertilionidæ*, and the other two families forming side branches. The number of these bats being so great, all that can be done here will be to select a few of the better-known examples of some of the more important genera.

THE LONG-EARED BAT (*Plecotus auritus*)

The well-known long-eared bat, of which we give an illustration in the accompanying figure, is a common, though not very abundant, British species, easily recognized by the great length of its delicate ears. It is one of two representatives of the genus *Plecotus*, forming the type of a special group characterized by the presence of grooves, or incipient nose-leaves, on the upper part of the muzzle behind the nostrils; and also by the ears being generally very large, and united by their inner margins.

The long-eared bat has 36 teeth, of which $\frac{2}{3}$ on each side are incisors, and $\frac{5}{8}$ cheek-teeth; the premolars being, what is very rare in the family, $\frac{2}{8}$ in number. The ears are much more than twice the length of the head, and are united for a considerable distance; their tragus being also large. The general color, like that of all British bats, is sombre, being brownish gray above and paler on the under parts. This bat has a very wide geographical distribution, being found over the greater part of Europe, in Northern Africa, and probably also in most of the temperate regions of Asia; so that its known range extends from Ireland in the west to the Darjiling Himalaya in the east.

In the great development of its ears, as well as in the presence of groovings on the nose (which in other forms of the group develop into incipient nose-leaves), the long-eared bat and its allies occupy the highest, or most specialized position among the typical bats. This large size of the ears is in all probability connected with the nocturnal habits of this species; and it would appear that these organs to a large extent serve the same purposes as the large nose-leaves of the horseshoe-bats. That the long-eared bat is mainly nocturnal in its habits is clearly stated in the second edition of Bell's *British Quadrupeds*, where it is mentioned that although this species may often be seen hawking after flies with the short-eared pipistrelle in the evening, yet that it is late in coming forth from its diurnal resting-place, and that its flight is continued throughout the night. The presence of this bat may be recognized by its cry, which, when once known, can always be distinguished from that of all other species; and the author of the work just cited tells us how this cry may be heard at all hours of even the darkest night, whether the listener be in the open fields, in the neighborhood of woods, or near towns. The cry itself is described as being acute and shrill, although not loud; but practice only can enable observers to distinguish it from that of other bats.

In order to protect them from injury during the time that their owner is at rest, the long and delicate ears of this bat are at such times generally carefully folded away beneath the wings; and since the upright tragus is then left standing alone, the creature looks as if it had only short and slender ears. The ears both of this bat and of its North American ally are relatively longer than in any other



THE LONG-EARED BAT.
(Natural size.)

animal; and it is, indeed, probably solely due to the adventitious width communicated to the body by the wings that the ears do not appear monstrous and out of all proportion. The long-eared bat is a comparatively small animal, the length of the head and body being just short of 2 inches; while the ear measures about $1\frac{1}{2}$ inches, and the spread of the expanded wings reaches 10 inches.

The favorite hiding-places of these bats in inhabited districts are church towers, or within the roofs of open buildings or outhouses; and in such places they may be found in the daytime during the summer months hanging in large clusters, and in the winter carefully ensconced in such crannies and nooks as afford the best protection. In a rock-cut tomb in the Libyan desert visited many years ago by the late Professor Leith Adams, the long-eared bats, which were at that time regarded as distinct from the present species, were met with in swarms. "So plentiful were they," writes Professor Adams, "that during my descent into the crypt I was covered with them, while hundreds fluttered about like bees around a hive." In North America and Vancouver island, the long-eared bat is represented by an allied species, the American long-eared bat (*P. macrotis*), readily distinguished by some peculiar gland-like swellings in the region of the nose. Its habits appear to be very similar to those of the European species.

THE BARBASTELLE (*Synotis barbastellus*)

The barbastelle appears to be one of the rarest of all the British bats, and, like the long-eared bat, is one of two species severally representing a distinct genus. This bat, which belongs to the same group of genera as the species last mentioned, is readily distinguished from the latter externally by the comparatively small size of its ears; while, if its skull be examined, it will be found to have only thirty-four, in place of thirty-six teeth; this reduction being due to the disappearance of one pair of premolars from the lower jaw. A further point of difference is to be found in the circumstance that, whereas in the long-eared bat the outer margin of the ear terminates suddenly near the corner of the mouth, in the barbastelle it is produced forwards, so as to extend above the mouth to the front of the eye.

The barbastelle is found over middle and southern Europe, extending as far north as England and Sweden, and it has also been obtained from North Africa and Arabia, while it may extend, as Dr. Dobson suggests, into the temperate regions of Asia lying to the north of the Himalayas.

When examined closely, the appearance of the head of the barbastelle is so peculiar as to render its recognition always an easy matter. Thus, the muzzle is abruptly truncated and marked by a groove leading up each side to the nostrils; the latter being situated in a depression void of hair on the upper surface of the muzzle. The black hair on the somewhat swollen cheeks also adds to the peculiarity of the physiognomy; while the ears are relatively broad, and nearly equal in length to the head. The long fur is darker than that of any other European bat, and on the upper parts is brownish black, with the points of the hairs lighter; while on the under parts the light tips of the hairs are longer. The length of the head and body is two inches, and that of the ears half an inch. One white example of this bat has been recorded, and also another in which, while the head and neck were of the normal tint, the body was white.

Contrary to the habits of the long-eared bat, the barbastelle is a solitary species, both when in repose and during active life. "If," observe the authors of the second edition of Bell's *British Quadrupeds*, "in a twilight stroll about midsummer,

a person finds himself in close proximity to a bat of somewhat thick and clumsy form, but of rather small size, whose flight is so desultory that it appears to be flapping lazily about hither and thither, seemingly without purpose, and intruding so closely that the flutter of its wings may be heard, and even the cool air thrown by their movement felt upon the cheek, it may with almost certainty be regarded as the barbastelle. Although there is no English bat which resembles the barbastelle in its mode of flight, yet in choice of situation there are several. Where the whiskered bat and pipistrelle are seen, the barbastelle may be seen also; but, having been once observed, it will probably be useless to make search again at the same place. Equally uncertain is its diurnal retreat; most likely not the same place for



THE BARBASTELLE.
(Natural size.)

long together, as we have found it in places where it could not have rested the day previously. A crevice in a wall or tree, the spaces between the rafters and tiles of a cow-shed, the timber over a saw-pit, the thatch of a shed in a brickyard, or behind a cottage window shutter, are suitable places of repose for the barbastelle, in all of which situations we have met with it, and always alone." The barbastelle appears earlier in the evening than the long-eared bat, and probably retires as the night advances.

As we have already mentioned, the genus *Synotis* resembles *Plecotus* in being represented only by two species. Whereas, however, the second species of long-

eared bat is North American, the second kind of barbastelle is a Himalayan species. The Himalayan barbastelle (*S. darjilingensis*) is distinguished from its European congener by its larger ears, which lack the projecting lobe found on the outer margin of those of the latter. This bat appears to be common in the Himalayas, and has been captured in localities so far apart from one another as Gilgit and Darjiling. It is generally found at altitudes varying from about five thousand to eight thousand feet above the sea. In habits the Himalayan barbastelle appears to be very similar to its European relative; showing itself, however, rather late in the evening, and hibernating in the narrowest crevices and chinks of rocks into which it can contrive to crawl. There are four other bats allied to the long-eared bat and barbastelle, which are referred to three distinct genera. One of these is Hemprich's eared-bat (*Otonycteris hemprichi*) from North Africa and the Northwest Himalayas, which is characterized by having only thirty teeth, owing to the reduction in the number of the upper incisors and premolars to a single pair each. Its ears are considerably longer than the head. The second genus, *Nyctophilus*, comprises one species from Australia and a second from New Guinea, which, while possessing the same number of teeth as Hemprich's bat, are distinguished by the possession of a rudimentary nose-leaf. Finally, we have the Californian cave-bat (*Antrozous pallidus*), in which there are only twenty-eight teeth, owing to the reduction of the number of lower incisors to two pairs (a feature unique among the typical bats), the genus being also distinguished from all the members of the family hitherto mentioned by the ears being disconnected with one another.

THE PIPISTRELLE, NOCTULE, AND SEROTINE

Genus *Vesperugo*

The pipistrelle, noctule, and serotine, of which the first and second are figured among our illustrations, are the three best-known British representatives of the large and widely-distributed genus *Vesperugo*; the pipistrelle (*V. pipistrellus*) being the common English bat. With these bats we enter upon the consideration of a group of genera, distinguished from that containing the long-eared bat and its allies by several more or less important features. Among these may be mentioned the simple nature of the nostrils, which are without any trace of groovings or foldings of the skin, while the ears are usually of comparatively small size, and are always quite separate from one another.

The bats included in the same genus (*Vesperugo*) as the pipistrelle are very numerous, and vary to a certain extent in personal appearance, and also in the number of their teeth, which is either thirty, thirty-four, or thirty-six. Dr. Dobson says that they may be easily recognized by their relatively stout bodies, their broad and flattened heads and blunt muzzles, as well as by their broad, short, and triangular ears, in which the tragus is usually rather thick and inclined somewhat inwardly. Moreover, their legs are unusually short, and the membrane connecting the legs with the tail almost always has a small supplemental portion situated on the outer side of the spur rising from the heel.

Certain species of the genus approximate, however, in some of their characteristics to bats of other groups; one coming so close in general appearance to the long-eared bats that, without careful examination, it might readily be mistaken for a member of that group. "This genus of bats," observes Dr. Dobson, "probably contains the greatest number of individuals among the Chiroptera. The common bats of all countries, especially of those lying within the tropical and subtropical regions of the northern hemisphere, generally belong to it. . . . The color of the fur is generally dark brown or black, the extremities of the hairs being of a paler color on the upper surface, and ashy or whitish beneath." One species of this



THE PIPISTRELLE.
(Natural size.)

genus (*V. borealis*) has the most northern range of all bats, having been observed flying within the limits of the Arctic circle.

The pipistrelle, which we take as the first example of the genus, belongs to the typical section of *Vesperugo*, in which the incisors number $\frac{2}{3}$ and the premolar teeth are $\frac{2}{2}$ on either side of the jaws. It is a small species, measuring 1.65 inches in length of head and body, and with a span of wing of about $8\frac{1}{2}$ inches. The fur is rather long and silky, of a yellowish-red color near the roots of the ears, but elsewhere reddish brown above, and dusky beneath. This bat, the smallest of the British species, is distributed all over Europe, the temperate parts of Asia, and North

Africa. It does not enter India, but is found in the valley of Kashmir, and also at our frontier station at Gilgit.

This being the commonest of the British bats, and also one which frequents the neighborhood of human habitations, we are naturally more fully acquainted with its habits than with those of many other species ; and the following account is mainly derived from the excellent description given in Bell's *British Quadrupeds*. The pipistrelle appears earlier and retires later than any other English bat, making its first appearance as early as the middle of March, and not finally hibernating till winter has actually set in. Its flight is extremely swift and rapid, and accompanied by the sudden turns and descents which have probably been observed by all. The favorite resorts of this species in inhabited regions appear to be old buildings and roofs, but it seems to avoid the roofs of stacks and ricks, which might have been thought to have afforded safe cover. Probably, however, this avoidance may be due to the rats and mice which are so frequently found in such situations. Trees appear to be but seldom selected, either as a temporary hiding place, or for the hibernation. In uninhabited districts crannies and clefts in rocks serve as shelter. The favorite food of the pipistrelle is said to be gnats ; and the abundance of these insects on some of the warmer days of winter is probably the reason why one or more of the bats may be occasionally seen flying about at that season. In captivity this bat will readily eat meat ; and it is said that it will at times visit larders for the sake of food of that nature.

In India the place of this bat is taken by a closely allied species, the Indian pipistrelle (*V. abramus*), which also ranges as far east as Northern Australia, and, in summer at least, as far west as Central Europe. It may be at once distinguished from the common species by the outer margin of the ear being straight, instead of concave, below the tip. As the pipistrelle is the commonest bat in England, so its Oriental representative is probably the most abundant species in India, where it ranges from the Himalayas to Ceylon. Its habits are described as being similar to those of the ordinary species, the same partiality for human dwellings being exhibited, and the flight being characterized by similar sharp doublings and turns.

Among the representatives of *Vesperugo*, our remarks will, in the
Noctule main, be restricted to those found in the British Isles ; and we accordingly pass to the consideration of a species much larger than the preceding, and known as the great bat, or noctule (*V. noctule*). This species, of which we give a figure on the next page, belongs to the same section of the genus as the pipistrelle, and is perhaps the best known of the larger British bats. Apart from its larger size, it is distinguished from the pipistrelle by its broad and rounded ears, which are set very far apart on the head. The color of the upper parts is yellowish brown, only very slightly paler below ; but some examples have been described with a reddish tinge. The length of the head and body is three inches, and the spread of the wings from thirteen inches to more than fourteen. This bat has a wider distribution than the pipistrelle, being found not only all over Europe and the temperate regions of Asia, but likewise ranging into Africa north of the Sahara, and also occurring in Java and Sumatra, and entering the confines of Anglo-Indian dominions in Nipal and Sikhim, and not improbably Kandahar.

The noctule differs from the pipistrelle in being a tree-haunting bat, and likewise a gregarious species. In winter, however, its retreat may be either in hollow trees, or under roofs and eaves of houses, in which situations numbers may frequently be found together. It appears early in the evening, and its flight is particularly strong and rapid, and takes place high in the air. Its favorite food consists of cockchafer and fernchafers, in pursuit of which it may be seen on summer evenings hawking round large trees, especially oaks. An unpleasant odor is characteristic of this bat.

"The noctule," writes Bell, "is essentially adapted for the capture and mastication of coleopterous insects. The broad muzzle and strong jaws are found quite



THE NOCTULE.
(Natural size.)

equal to the reduction of the stubborn elytra of beetles as large as the cockchafer (of which, according to Kuhl, he will consume as many as thirteen, one after the other), and the wings are in no way deficient in power when in pursuit of these insects. During the fine midsummer evenings, when the cockchafers have become abundant, and you hear them humming on every side, the noctule is in his glory. Then he flies high and straight, and you hear his shrill but clear voice as he passes overhead, interrupting himself to dart at some prey, and then passing on. But an observer will not watch his movements long on such an occasion without noticing a

manceuvre which at first looks like the falling of a tumbler-pigeon, but on closer observation proves to be simply the closing of the wings, and a consequent drop of about a foot. Sometimes this is repeated every few yards as long as he is in sight. It is occasioned by some large and intractable insect having been captured, and the anterior joint of the wing, with its well-armed thumb, is required to assist in retaining it until masticated. Sometimes, however, food is not so easily obtained. With a cold east wind, or, indeed, a strong wind from any quarter, a change of hunting-ground is required; and the noctule may often be seen taking a humble and silent flight in some sheltered and warm corner, fluttering about with half-closed wings, and appearing to be very little at home, or indeed like himself, for we recall an instance where several were shot under the belief that they were of some unknown species."

In Sikkim and Nipal the habits of the noctule appear to be much the same as in Europe, but it does not hibernate. In Nipal it appears to be of rare occurrence, as Dr. Scully states that he only procured one specimen, which was caught in the following manner, during the month of July: "About eight o'clock in the evening," writes Dr. Scully, "I heard the very shrill scream of some small animal in my bedroom, and, on going into the room, I found this bat attached to the mosquito net covering my bed. In its flight, it had apparently alighted on the net, and there got its claws so firmly entangled that it could not escape."

In White's *Natural History of Selborne*, it is stated that the noctule is not to be seen on the wing before the end of April, nor later than July. Other observers have, however, seen this bat in Hampshire and Sussex in August and September, while one instance is on record of its appearance in Cambridgeshire as late as the first week in November.

Hairy-Armed Bat

Closely allied to the noctule is the British species known as the hairy-armed bat (*V. leisleri*). Its popular name is derived from the presence of a broad band of fine short hairs on the under side of the wing membrane running from the fore-arm to the wrist. Since, however, this feature is also found in the noctule, it is obviously not distinctive of the species to which it gives the name, and we must therefore seek for another characteristic by which to distinguish the two species. Such a characteristic is found in the incisor teeth. In the hairy-armed bat the outer pair of these teeth in the upper jaw is equal in cross-section at the base to the inner pair, but the height of their crowns is much less; whereas in the noctule the former is much wider at the base than the latter, while it also has the crown hollowed out to receive the summit of the lower tusk, or canine. Then, again, the lower incisor teeth in the hairy-armed bat form a regular semicircle, with scarcely any overlapping of one over another; whereas in the noctule they have broad crowns, are set obliquely in the jaw, and largely overlap one another. Such characteristics may seem trivial and unimportant, but they are amply sufficient to prove the specific distinctness of the hairy-armed bat, which is, moreover, a considerably smaller animal than the noctule, the combined length of the head and body being rather less than two and a half inches. Needless to say, however, these two bats are often confounded together, although careful attention to the points mentioned will always serve to distinguish them. Moreover, careful

observers will readily discriminate between these bats, even when on the wing, from their difference of habit and mode of flight. "Whilst the noctule," observe the authors of Bell's *British Quadrupeds*, "may throughout the whole of the summer be seen taking its regular evening flight, night after night, near the same spot, the Leisler's bats, on the contrary, will be seen once, perhaps for a few minutes only, and then lost sight of. It appears to affect no particular altitude in its flight, any more than it preserves a regular or prescribed beat. When the weather is fine, you may see this bat passing on in a kind of zig-zag manner, apparently uncertain where to go; generally, although not always, at a considerable elevation, and in a few minutes it is gone." Like the noctule, the hairy-armed bat has a wide geographical distribution, ranging through Europe and the temperate regions of Asia, and having been recorded from one locality in the Himalayas.

Serotine The serotine (*V. serotinus*) is another large British bat belonging to a group distinguished from that containing the preceding species by the premolars in the upper jaw being reduced to one on each side. This bat has ears of moderate size, with broadly-rounded tips, and the tragus broadest just above the base, and thence gradually diminishing in width to the rounded tip. The general color of the fur is chestnut brown above, and yellowish gray on the under parts; the hair being long and silky, and the wing membranes dark brown, or nearly black. There is, however, some degree of individual variation in color, specimens being occasionally found with a grayish tinge to the fur.

The serotine is of particular interest as having the widest distribution of any known bat, and being the only representative of the order Chiroptera which is common to the eastern and western hemispheres. Seeing that bats are, from their power of flight, able to traverse with ease long distances over sea, it seems at first sight very remarkable that the serotine is the only species which has succeeded in crossing from the Old World to the New. It is, however, probable that most of these animals are unable to withstand the cold of the regions about Behring Strait, where the passage between the two hemispheres is the shortest, and have hence failed to spread themselves in the same manner as purely terrestrial Mammals like the reindeer, elk, and glutton.

The range of the serotine extends from England to Siberia, and from Northern Germany to Northern Africa, whence it is continued through Arabia and Asia Minor to the valleys of the Himalayas. In Africa, it is found as far south as the Gabun district on the west coast, and it probably extends to the Camerun mountains. In America, where it was at one time regarded as distinct from the European species, it appears to be widely spread from Lake Winnipeg in the north to the Isthmus of Darien, and is met with throughout all the West Indies. The serotine from the Gabun constitutes a distinct variety, distinguished by the fur of the under parts being of a pale yellowish white, and thus forming a marked contrast with the dark brown fur of the back.

The serotine, which is a comparatively rare and local species in England, is said to have very similar habits to the noctule, so far as regards the length of its period of hibernation, and its consequent late appearance in the spring are concerned. It is nearly always found alone, and has a characteristically slow fluttering flight;

while, as its name implies, it does not venture forth till late in the evening, and, in suitable weather, continues on the wing till dawn. The southern counties appear to be the only part of England in which this bat is found; but in France, and other continental countries, it is widely distributed, and far from uncommon. Observers in the country last named state that it may generally be found flying around the tallest trees in forests; and that it frequents the timber yards in Paris, among the woodstacks of which it conceals itself during the day. In North America, where it is known as the dusky, or Carolina, bat, the habits of the serotine appear to be very nearly the same as in Europe. Thus, in writing of these bats, Dr. A. K. Fisher observes that "they are the last to make their appearance in the evening. In fact, when it gets so dark that objects are blended in one uncertain mass, and the bat-hunter finds that he is unable to shoot with any precision, the Carolina bats make their appearance as mere dark shadows, flitting here and there while busily engaged in catching insects. We have to make a snap shot as they dodge in and out from the dark tree tops; and we are left in doubt as to the result until in the gloom we may perchance see our little black-and-tan, seemingly as interested in the result as we are, pointing to the dead animal. This species is particularly fond of fields well surrounded by trees."

**Parti-Colored
Bat**

The last of the bats of the genus *Vesperugo*, reckoned as British, is the parti-colored bat (*V. discolor*), which, while belonging to the same group as the serotine, differs in that the widest part of the short tragus is above, instead of below the middle. Apart from this, the parti-colored bat is, however, readily distinguished by the comparative richness of its coloration, which has a somewhat marbled appearance, owing to the light tips of the hairs. Above, the color of the fur is reddish brown, with the tips of the hairs white; while all the under parts are of a dirty white tint. Up to the year 1874 only one individual—captured at Plymouth—of this bat had been obtained in Britain, and we are not aware that any instance of occurrence has been recorded since. It has accordingly been suggested that the Plymouth example may have been imported in the rigging of some ship. On the Continent the parti-colored bat is widely spread, but it is chiefly found in mountain districts; its range extending from Italy and France to Southern Sweden and the Ural mountains. In Asia it has been observed in Western Siberia and Eastern Turkestan.

**Silver-Haired
Bat**

The last member of the genus to which we allude is a North-American species, known as the silver-haired bat (*V. noctivagans*), which is the sole representative of a group characterized by having three premolar teeth on each side of the lower jaw, and also by the hairiness of the membrane between the legs. In the upper jaw there are two premolars on each side. The fur above is dark brown, becoming silvery white at the tips in the region of the back; and there is a very characteristic white spot at the base of the brown ears.

The silver-haired bat has the most northern range of any American species, extending to Hudson's Bay, and southward to California. In the Adirondack mountains, near New York, Dr. Hart Merriam states that it is by far the commonest of all the bats. "Like many bats," writes Dr. Merriam, "it has a decided

liking for waterways, coursing up and down streams and rivers, and circling around lakes and ponds. In some places its habit of keeping directly over the water is very marked. At Lyon's Falls it is exceedingly abundant, particularly just below the falls. I have stood, gun in hand, on a point on the east bank of the river, and have seen hundreds passing and repassing, flying over the water, while during the entire evening not more than two or three strayed so far that if shot they would fall on land. Several that were wounded and fell into the water, at a distance of twelve or fifteen feet from the bank, swam ashore. They swam powerfully and swiftly, for the current is here quite strong, and would otherwise have carried them some distance down stream. Next to water courses, the borders of hard-wood groves are the favorite haunts of the silver-haired bats. By standing close under the edge of the trees one sees many that at a little distance would pass unobserved. While searching for their insect prey they may be seen to dart in and out among the branches, and to penetrate, in various directions, the thick mass of foliage overhead. They often pass within a few inches of one's face, and yet it is rare that a sound is heard from their delicate wings. In the early dark the silver-haired bat emerges from its hiding place; after a few turns about the immediate neighborhood, it generally takes a pretty direct course for water. I have seen it start from the summit of a high, densely wooded hill, circle around for a few minutes, and then, keeping far above the tree tops, sail leisurely toward a distant river till lost from sight in the valley below. And, standing on the banks of the large stream that winds along the foot of the hill, I have seen the bats flying over at a height of several hundred feet, all moving in the same direction—toward a more distant river. Whether it remains abroad all night, or limits itself to comparatively brief excursions in evening and early morning, can only be conjectured. I am inclined to favor the latter view, for the reason that the greater number always disappear before the darkness becomes sufficiently intense to hide them from sight."

We may conclude this somewhat long account of the genus *Vesperugo* (which is, however, short in comparison with the extent of the genus) by mentioning that there are three species which differ from all the rest in having only a single pair of incisors in the upper jaw. These species are *V. schlieffenii*, of Africa, *V. dormeri*, of Southern India, and *V. parvulus*, of Central America.

THE HOARY BAT AND RED BAT

Genus *Atalapha*

Omitting all mention of two genera of bats (*Chalinolobus* and *Nycticejus*) unknown in Europe, our next representatives of the family *Vespertilionidæ* will be two species of a genus known as *Atalapha*, which is confined to the New World. All these bats have only a single pair of upper incisor teeth; the number of incisors in both jaws being $\frac{1}{3}$, and the cheek-teeth either $\frac{5}{3}$ or $\frac{4}{3}$, so that the total number of teeth is 32 or 30. They are also characterized by the membrane between the legs being more or less hairy; and by the expansion and inward curvature of the extremity of the tragus of the ear.

The largest of the more typical species of this genus is the well-known hoary bat (*A. cinerea*), ranging from Nova Scotia to Chili, and characterized by its ashy-gray color. Dr. Hart Merriam, writing of the habits of this fine bat in the Adirondack mountains near New York, observes that it "can be recognized, even in the dusk of evening, by its great size, its long and pointed wings, and the swiftness and irregularity of its flight. It does not start out so early as our other bats, and is consequently much more difficult to shoot. The borders of woods, water courses, and roadways through the forests, are among its favorite resorts; and its nightly range is vastly greater than that of any of its associates. While the other species are extremely local, moving to and fro over a very restricted area, this traverses a comparatively large extent of territory in its evening excursions, which fact is probably attributable to its superior powers of flight." Of the migratory habits of this bat, which is rare in the Adirondack region, we have already written.

Far commoner in the Adirondacks is the red or New York bat (*A. noveboracensis*), which is of smaller size, and conspicuous for its bright golden fur, tipped more or less markedly with silver. This species, which is second only in beauty to the hoary bat, is widely distributed in North America, and represented by several varieties in South America. According to the writer last quoted, it generally makes its appearance earlier than the other species, and may even be occasionally seen abroad on cloudy afternoons long before the shades of evening have begun to fall. Dr. Coues states that "in most portions of the United States the red bat is one of the most abundant, characteristic, and



HEAD OF HOARY BAT.
(After Dobson.)

familiar species, being rivaled in these respects by the little brown bat (*Vespertilio subulatus*) alone. It would be safe to say that in any given instance of a bat entering our rooms of an evening, the chances are a hundred to one of its being one of these two species. The perfect noiselessness and swiftness of its flight, the extraordinary agility with which it evades obstacles—even the most dexterous strokes designed for its capture—and the unwonted shape, associated in popular superstition with the demons of the shades, conspire to produce repulsive feelings that need little fancy to render weird and uncanny."

As is the case with many of its North American allies, this bat generally hibernates in large colonies, which select for their retirement a cave or hollow tree. The following account of a visit to a cave, in the year 1816, probably refers to this species, and gives a good idea of the vast numbers of individuals composing one of these colonies. The describer, Professor J. Green, as quoted in 1842 by Dr. J. D. Godman, writes that "I this day (November 1st) visited an extensive cavern about twelve miles south of Albany, New York. I did not measure its extent into the mountain, but it was at least 300 or 400 feet. There was nothing remarkable in this cave except the vast multitudes of bats which had selected this unfrequented place to pass the winter. They did not appear to be much disturbed by the light of the torches carried by our party, but upon being touched with sticks, they

instantly recovered animation and activity, and flew into the dark passages of the cavern. As the cave was, for the most part, not more than six or seven feet in height, they could very easily be removed from the places to which they were suspended, and some of the party who were behind me disturbed some hundreds of them at once, when they swept by me in swarms to more remote, darker and safer places of retreat. In flying through the caves they made little or no noise; sometimes upon being disturbed in one place they flew but a few yards and then instantly settled in another. These bats, in hibernating, suspend themselves by the hinder claws from the roof or upper part of the cave; in no instance did I observe one along the sides. They were not promiscuously scattered, but were collected into groups or clusters of some hundreds, all in close contact. On holding a candle within a few inches of one of these groups, they were not in the least troubled by it; their eyes continued closed, and I could perceive no signs of respiration."

As an instance of the weight of the young which female bats have sometimes to carry with them, we may refer to an account by Mr. W. H. Hudson, who states that in La Plata he once captured a female bat, which, although mentioned by another name, appears to have belonged to a variety of this species. This bat had attached to her breast two young ones, which were so large that it seemed incredible how she could fly when thus burdened, much less with sufficient speed to catch her insect food. Mr. Hudson states that these young ones were fastened on each side of the body of the parent; and when forcibly separated from their hold were incapable of flight, and fluttered feebly to the ground. The weight of the young in this instance was not, indeed, so relatively great as in the case of the opossum, where seven or eight young may sometimes be seen clinging to the tail and back of the female; but then it must be remembered that the opossum has only to climb, when it can use both its claws, teeth, and prehensile tail to aid its movements. The bat, on the other hand, had to seek its living in the empty air, pursuing its prey with the swiftness of a swallow, "and it seemed wonderful to me," writes Mr. Hudson, "that she should have been able to carry about that great burden with her on one pair of wings, and withal to be active enough to supply herself and her young with food. In the end I released her, and saw her fly away among the trees, after which I put back the two young bats in the place I had taken them from, among thick clustering foliage of a small acacia tree. When set free they began to work their way upwards through the leaves and slender twigs in the most adroit manner, catching a twig with their teeth, then embracing a whole cluster of leaves with their wings, just as a person would take up a quantity of loose clothes and hold them tightly by pressing them against the chest. The body would then emerge above the clasped leaves, and a higher twig would be caught by the teeth, and so on successively, until they had got as high as they wished, when they proceeded to hook themselves to a twig and assume the inverted position side by side; after which, one drew in its head and went to sleep, while the other began licking the end of its wing, where my finger and thumb had pressed the delicate membrane. Later in the day I attempted to feed them with some small insects, but they rejected my friendly attentions in the most unmistakable manner, snapping viciously at me every time I approached them. In the evening I stationed myself

close to the tree, and presently had the satisfaction of seeing the mother return, flying straight to the spot where I had taken her, and in a few minutes she was away again and over the trees with her twins."

As the narrator well remarks, this incident is noteworthy not only as a touching instance of parental affection, but likewise for the circumstance that the young bats, which up to the time of their capture had existed in a kind of parasitical condition, when thrown upon the world were quite capable of taking care of themselves. In other Mammals born in a helpless state, the power of accommodating themselves to new conditions, and the instinct of self-preservation, are acquired gradually, whereas in these young bats they were assumed in a moment.

THE TUBE-NOSED BATS

Genus *Harpyiocephalus*

The production of the nostrils into a pair of tubes has already been noticed as distinctive of a genus of fruit-bats (p. 259), and it is, to say the least, remarkable to find the same feature reappearing in a less marked degree in a group of insectivorous bats belonging to the *Vespertilionidæ*. These tube-nosed bats, constituting the genus *Harpyiocephalus*, are restricted to Tibet, India, Ceylon, and the Malay Archipelago, and Japan, where they always inhabit hilly districts. They are sufficiently distinguished at a glance from all the other insect-eating bats by their divergent tube-like nostrils, of which the apertures are circular. It may, however, be added that their teeth are 34 in number, of which there are on each side $\frac{2}{3}$ incisors, a single canine, and $\frac{5}{5}$ cheek-teeth. Moreover, the upper surface of the membrane between the hind legs is characterized by its thick covering of hair. The greater number of the eight species of these bats occur in Tibet and the Himalayas, some of them also extending into the highlands of India and Ceylon; there is also one from Java and some of the other Malayan islands, and another from Japan. The white-bellied tube-nosed bat (*H. leucogaster*) of the Himalayas is remarkable for its brilliant coloration, the fur being golden orange on the head, the base of the hairs grayish, and on the back pale rufous brown with gray at the base. The fur on the membrane is bright ferruginous, the upper surface of the interfemoral membrane and toes being well covered. Beneath, the fur is white throughout on the chin and throat, the rest of the lower parts having bicolored fur—gray at the base with white tips.



HEAD OF TUBE-NOSED BAT.
(After Dobson.)

Writing of its habits in the Northwest Himalayas, Captain Hutton says that it occurs at an elevation of about 5,500 feet, but does not appear to be common in the hills, the Dehra-Doon being probably its true locality there. An example which flew into a room at Jeripani (below Masuri), at night, kept low down in its flight, instead of soaring towards the ceiling, passing the tables and chairs, as if afraid to

emerge into the broad glare of the lamps. This is likewise the mode of flight when searching for insects in the open fields, where it skims closely and somewhat leisurely over the surface of the crops and grass.

DAUBENTON'S BAT, NATTERER'S BAT, ETC.

Genus *Vespertilio*

Daubenton's bat (*Vespertilio daubentoni*), represented in the illustration below, is a well-known, although local British species, which we select as our first ex-



DAUBENTON'S BAT.
(Natural size.)

ample of the genus *Vespertilio*, second only in point of the number of its species to *Vesperugo*, and the type of the family *Vespertilionidæ*. The bats of this genus have 38 teeth, of which there are $\frac{2}{3}$ incisors and $\frac{8}{3}$ cheek-teeth on each side of the jaws. As Dr. Dobson observes, they are easily recognized by the circumstance that the upper incisor teeth are so implanted in the jaws as to diverge from one another; and also by the large number of the cheek-teeth, which exceeds that obtaining in any insectivorous bats yet noticed, and is only equaled in four other genera, of which three are mentioned later on. Moreover, the second cheek-tooth in the upper jaw,

belonging to the premolar series, is invariably characterized by its minute size. Then, again, the ear has a characteristic elongated oval form, and its tragus is very narrow.

The genus appears to be of unusually wide geographical distribution, and is found throughout the temperate and tropical regions of both hemispheres. "Most of the species," writes Dr. Dobson, "appear to be dwellers in woods, some either habitually or occasionally live in caves or under the roofs of houses. The position of attachment of the wings to the hinder extremities, and the size of the foot, appear to be connected with the nature of their dwelling-places, the inhabitants of caves having larger feet more or less free from the membranes, while those living in woods have much smaller feet inclosed in the wing membrane to the base of the toes." The bats of this genus being of a more delicate organization than the species of *Vesperugo* are less capable of withstanding the effects of cold, and have therefore a less northerly range than the later. And in the countries where the bats of these two genera hibernate, those belonging to the present genus are later in awakening from their winter slumber than are the species of *Vesperugo*.

Daubenton's bat belongs to a group of the genus characterized by the large size of the feet, and also by the wing membrane rising, as a rule, from the shin bone or the ankle, as well as by the middle of the free margin of the membrane between the legs forming a very acute angle. Moreover, the tail has one or two joints projecting beyond the edge of the membrane last mentioned, and the spur arising from the ankle to support the same is of very great length. The wing membrane extends below the ankle to the metatarsus; and the ears are characterized by their oval form, and are rather shorter than the head. The length of the head and body is two inches, and the span of the wings nine inches. The fur is brownish black at the base, and usually reddish brown on the upper parts and ashy gray below; although there is considerable individual variation in this respect.

This bat is chiefly characterized, so far as habits are concerned, by its partiality for the neighborhood of water, and from this peculiarity it is frequently overlooked, even in districts where it is abundant. So close, indeed, does it fly to the surface over which it skims, writes Professor Bell, that it is "difficult to distinguish between the creature itself and its reflection. The flight, quivering and slow, is performed by very slight but rapid strokes of the wings. It may, indeed, be said to vibrate rather than fly over the surface of the water. It could not well fly in any other manner so near the surface without often striking it, and this it seldom, or perhaps never, does, although it often pauses to dip its nose into the water, whether to drink or pick up some food we have been unable to ascertain. The Daubenton's bat is, we suspect, rather an abundant species in the middle parts of England; at least it is plentiful in some parts of Warwickshire. We have sometimes seen these bats so thick on the Avon, near to Stratford, that at certain spots there could not have been fewer than one to every square yard, and this abundance has extended over a very considerable space. It resorts indiscriminately to buildings or trees during the day, though we think the preference is given to the former." The last observation is in harmony with the opinion of Dr. Dobson already quoted, in which it is stated that the species with the large feet choose buildings for resting places in preference to trees.

This bat is found in England, Scotland, and Ireland, and appears to extend over the greater part of Europe, having been recorded from Finland to Sicily. It also extends into Asia, where it probably ranges over most of the temperate regions to the northward of the Himalayas, while on the eastward of the Bay of Bengal it extends southward into the Tenasserim provinces. It is sometimes termed the water-bat.

The rough-legged bat (*V. dasycneme*) is another species belonging to the same group of the genus, which has been recorded from the southern countries of England. In it the wing membrane extends only to the ankle; and the species is readily distinguished from the rest by the form of the tragus of the ear, which approaches that of the serotine, and also by the thinness of the hair on the face. It is widely distributed on the Continent, but has only of late years been recognized as British.

The reddish-gray, or Natterer's, bat (*V. nattereri*) is also a British species of very local occurrence, and belongs to the second or typical group, of the genus *Vespertilio*. This group is characterized by the smaller size of the foot, by the wing membrane generally extending down the leg as far as the base of the toes, and also by the obtuse angle in the middle of the free hinder margin of the membrane between the legs. Moreover, the tail is either wholly contained within the margin of the membrane, or has only its extreme tip projecting beyond; while the spur arising from the ankle to support this membrane is shorter, reaching only to half instead of three-quarters of the distance between the ankle and tail. The color of its fur is lighter than that of any other British species. This bat is characterized by the relatively small size of its head; and its fur is of a reddish-gray color above, and whitish beneath. Owing to the smallness of the head, the total length of the head and body is somewhat less than in Daubenton's bat, but the span of the expanded wings is two inches more, and thus reaches eleven inches.

In habits it is a sociable species, being found in large numbers in its favorite places of repose, which are generally buildings, especially church towers. Thus, in the year 1848, an enormous colony was discovered in the roof and tower of the church of the village of Arrow, near Alcester. Its range extends from Ireland to the Ural mountains, and from the south of Sweden to the Alps.

Another closely-allied British species is Bechstein's bat (*V. bechsteini*), which is limited to Europe, and is of rather larger size than the last; the length of the head and body being 2 inches instead of 1.65 inches. It is distinguished by the hinder margin of the membrane between the legs being naked instead of fringed, and also by the shorter tail, of which the length is less than half that of the head and body. The color is reddish gray above and grayish white below. It is very rare in England, but has been taken in the New Forest.

We must not leave this group of the genus *Vespertilio* without referring to an African species remarkable for its gorgeous coloration. This is Welwitsch's bat (*V. welwitschi*), from Angola, on the West Coast. In this bat (which is closely allied to the last species), while the head and body are reddish above and straw colored beneath, the naked wing membranes are variegated with orange and black, the dark portions being of a triangular shape, and occupying the spaces between the

second and third, and third and fourth fingers, and also the space included between the fourth finger, and a line drawn between the wrist and the ankle; the remaining portions being orange. Then, again, the membrane between the legs is margined behind by a black band, and dotted over with small black spots; similar dots also occurring upon the the orange-colored portions of the wings between the arms and legs. Hodgson's bat (*V. formosus*) of India and China, which is more nearly related to the under-mentioned whiskered bat, has an almost identical coloration, the only difference being that the membrane between the legs is wholly orange, and the black spots are wanting from the wings.

While on the subject of brilliantly-colored bats, we may mention two other species belonging to different genera. One of these is the Indian painted bat (*Cerivoula picta*), belonging to a genus (*Cerivoula*) closely allied to *Vespertilio*, but distinguished by having the upper incisor teeth parallel instead of divergent. In this bat the fur on the upper parts is a deep orange or ferruginous red, and that beneath paler. The wing membranes are black, with orange spots and lines of orange along the fingers and on the margins, while the membrane between the legs is wholly orange. So brilliant indeed is the species, that it is said to have the appearance of a gorgeous butterfly rather than a bat.

Our second example of contrasting coloration is the white-winged bat (*Nycticejus albofuscus*), the river Gambia, on the West Coast of Africa. The genus *Nycticejus*, which has been incidentally mentioned on p. 281, is closely related to *Vesperugo*. In color the body of the white-winged bat is dark amber brown both above and below; and the naked skin of all the portions exposed when the creature is at rest is likewise of a nearly similar hue. On the other hand, those portions of the wing membranes lying external to a line drawn from the elbow to the knee are pure white on both sides, thus contrasting very markedly with the dark tint of the body and limbs. All the other known members of the genus have the body and wings more or less uniformly colored; but, as observed by Mr. O. Thomas, the describer of this singular species, many of the smaller bats of the Gambia, belonging to several distinct genera, have dark bodies with white wings. That there is some good reason for this peculiar style of coloration among the Gambian bats is evident, although no explanation has hitherto been offered. With regard to the coloration of Hodgson's bat, it has been shown by the late Mr. Swinhoe that in the island of Formosa this species is in the habit of hanging suspended on the fruit of the longan tree (*Nephelium*). "Now this tree," writes Mr. Swinhoe, "is an ever-green, and all the year through some portion of its foliage is undergoing decay, the particular leaves being, in such a stage, partially orange and black. This bat can, therefore, at all seasons suspend itself from its branches, and elude its enemies by its resemblance to the leaf of the tree. It was in August when a specimen was brought to me. It had at that season found the fruit ripe and reddish yellow, and had tried to escape observation in the semblance of its own tints to those of the fruit." A similar explanation will doubtless hold good with regard to the Indian painted bat, which feeds on plantains, which, when ripe, are of a bright yellow or orange color, speckled with black, and thus almost exactly similar to the bat.

With the whiskered bat (*V. mystacinus*) we resume, and at the same time conclude, our survey of the British representatives of the genus. This bat, while agreeing in the relative size of the feet, and other leading characteristics, with Natterer's, belongs to a subgroup distinguished by the tragus being straight and more or less blunted at the tip, instead of being acutely pointed and inclining outwards. This bat is of small size, the length of the head and body being only one and one-half inches, and the spread of the outstretched wings eight and one-half inches. The fur on the upper part of the body is dark chestnut, tending to black, and dusky beneath. It takes its name from the fringe of long fine hair on the upper lip. It is a solitary species, although on some occasions a considerable number may be seen together on account of the abundance of food in particular localities. In its mode of flight and general habits it is very similar to the pipistrelle; hiding during the day in situations as various as are those favored by different individuals of that species. Its range includes the greater part of Europe, while in Asia it has been found in Syria, the Himalayas, and North China. It may be mentioned that no less than twelve species of the genus *Vespertilio* are peculiar to the New World, and that the whole of them are characterized by the small size of their feet.

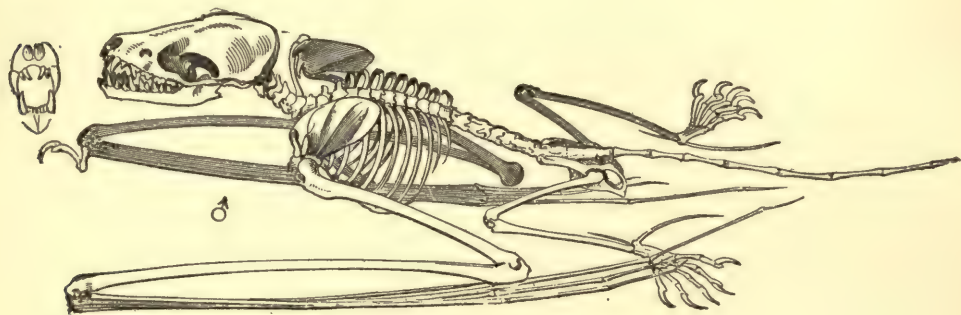
Schreibers' Bat This bat (*Miniopterus schreibersi*), which ranges from Germany to Japan and Australia, and is the sole representative of its genus, differs from all the preceding forms by the great elevation of the crown of the head above the face. The same feature is found in the South American and West Indian tall-crowned bats (*Natalus*), of which a head is shown in the figure. Both these bats are distinguished by the presence of a gap in the middle line between the first pair of incisor teeth, and by a second gap between the second incisor and the tusk. The American tall-crowned bats, while agreeing with *Vespertilio* in the number of their teeth, are further distinguished by the small size of the tragus of the ear. On the other hand, Schreibers' bat has but thirty-six teeth, owing to the absence of the first pair of premolars.



HEAD OF TALL-CROWNED BAT.
(Three times natural size.)
(From Dobson, *Proc. Zool. Soc.*, 1880.)

Sucker-Footed Bats Our notice of the Typical Bats may conclude with genera, each represented only by a single species, which are peculiar in having sucking organs on the thumbs or hind feet. One of these species is the tricolor bat (*Thyroptera tricolor*) of Brazil, and the other the golden bat (*Myxopoda aurita*) of Madagascar. Both have thirty-eight teeth, as in the genus *Vespertilio*. In the former the suckers on the extreme toes are in the form of round discs on the lower surfaces of the thumbs and the soles of the feet; while in the latter the sucker on the thumb is horseshoe like, and those on the feet are smaller. Both these bats are further remarkable for possessing three joints in the third or middle finger of the wing, in which respect they resemble the second family of the Free-Tailed Bats.

By the aid of their suctorial discs these bats are enabled to climb smooth polished surfaces, after the manner of cuttlefishes ; but a good and satisfactory account of their habits is still a desideratum. The occurrence of the two forms of sucker-footed bats in such widely remote regions as Madagascar and Brazil is one out of many instances indicating an intimate connection between the faunas of South Africa and South America.



SKELETON OF BAT (*Vespertilio*) IN CREEPING POSTURE.

The Free-
Tailed Insec-
tivorous Bats

The bats remaining for notice are arranged in two families, and differ so markedly from those described that they may be regarded as forming a separate branch derived from the same stock as that from which the Typical Bats have originated. From the circumstance that in many of these bats a greater or smaller portion of the tail is completely detached from the membrane between the hind legs, the whole group may be conveniently referred to as the Free-Tailed Bats ; and to them we devote a special chapter.

CHAPTER XI

BATS—*concluded*

THE FREE-TAILED INSECTIVOROUS BATS

THE chief distinctive features of this group are that, as a rule, the tail (when present) either penetrates the membrane between the legs, so that its extremity appears on the upper surface, or it is produced considerably beyond the hinder margin; secondly, that the innermost (frequently the only) pair of upper incisor teeth are generally of large size, and placed very close together; and, thirdly, that except in two genera, each represented by a single species, the first joint of the third or middle finger of the wing is, when at rest, folded back upon the upper surface of its supporting metacarpal, instead of being extended forward in the same line, as in the species we have hitherto described. Not a single representative of this large assemblage of bats is found in the British Isles, and, indeed, only one species occurs within the limits of the European area. They are mainly characteristic of tropical and subtropical regions; but whereas the first of the two families into which they are divided ranges over both Hemispheres, the second is strictly confined to the central and southern portions of the Western. The number of genera—to say nothing of species—included in the two families is very large, and as many of them are distinguished from one another by comparatively trivial characteristics, we shall notice only a few typical forms of special interest either from peculiarities of structure or of habits.

THE SMOOTH-NOSED FREE-TAILED BATS

Family *EMBALLONURIDÆ*

The first family of the group occupies a position precisely similar to that held by the Typical Bats (*Vespertilionidæ*) in the other branch of the insect eaters treated in the preceding section. In addition to the peculiar mode of folding the third finger of the wing, and the characteristics of the tail already alluded to, they are distinguished by the circumstance that there are but two bony joints in this third finger, as also by the absence of any distinct nose-leaf. As a rule, they have a small tragus in the ear, and only a single pair of upper incisor teeth, which incline towards one another. Moreover, the extremity of the snout is obliquely truncated from above downwards, so as to cause the nostrils to project more or less in front of the tip of the lower jaw. The family is widely distributed over the warmer regions of both the Eastern and Western Hemispheres, and includes one of the two species

which are the only representatives of the entire order (as, indeed, they are of the whole class of Mammals) found in New Zealand; but the range on either side is mainly restricted to the belt lying within thirty degrees of the Equator.

THE SHEATH-TAILED BATS

Genus *Emballonura*

The mountain sheath-tailed bat (*Emballonura monticola*) is a fairly well-known representative of a group of this family in which the tail is slender, and has its free extremity perforating the membrane between the hind legs, while the legs are relatively long, and the upper incisor teeth comparatively small and weak. The special characteristic of the genus is that there are two pairs of upper incisor teeth; the total number of teeth being 34, of which $\frac{2}{3}$ on each side belong to the incisor, and $\frac{5}{6}$ to the cheek series. The production of the muzzle is more or less strongly marked, the top of the head is flat, and the ears are not united, and have a tragus of somewhat oblong form, and expanded above.

The mountain sheath-tailed bat is of a chocolate-brown color, and measures about one and one-half inches in length, exclusive of the tail. It is found in Java, Sumatra, Borneo, and the Philippines; the other four species of the genus inhabiting various islands in the region extending from Madagascar to the Navigator group. The genus is, therefore, exclusively an insular one, and, in this respect, quite peculiar. The Polynesian sheath-tailed bat (*E. semicaudata*) is found in the Mergui archipelago lying off Tenasserim.

THE POUCH-WINGED BATS

Genus *Saccopteryx*

Omitting two small genera, we come to the remarkable pouch-winged bats (*Saccopteryx*) of Central and South America, which do not generally exceed two inches in length, and have fewer teeth than the foregoing; the number of incisors being $\frac{1}{3}$, and the cheek-teeth $\frac{5}{6}$ on each side. They derive their name from the presence of a peculiar glandular pouch on the under side of each wing, at or near the elbow joint. These pouches, which are well developed in the males but rudimentary in the females, secrete a red-colored strongly-smelling substance, which appears to act as a sexual attraction. In one species from British Guiana (*S. leptura*), these pouches are unusually large, and from each of them projects a prominent white frill of skin, which seems capable of being protruded and withdrawn at the will of the animal; the use of this is unknown. In Demerara these bats may be seen flying about quite close to the houses at dusk. Moseley relates that he caught an example of another species (*S. canina*) in Bahia, resting fast asleep on the bare bark of a large tree; the dense forest growth overheard making such an exposed situation quite dark enough for a resting place throughout the day. Nearly all the six species have the fur of a uniform dark brown color, although one has a reddish tinge.

THE TOMB-BATS

Genus *Taphozous*

These derive both their popular and scientific titles from one of the species being found in vast numbers in the ancient Egyptian tombs, where they were discovered during the first French Expedition to that country. The tomb-bats differ from the other members of the group in having only two pairs of incisor teeth in the lower jaw, and also by the circumstance that the upper pair of these teeth are shed in the adult state. Instead of the glandular pouches on the wings, characteristic of the preceding genus, most of these bats have pouches of a similar nature on the under surface of the chin; these being chiefly, and in some cases exclusively developed in the male sex. Many individuals, especially those taken during the hibernating season, have large deposits of fat around the root of the tail and the base of thighs. This is probably for supporting life during the hibernating season, which, from the more northerly range of this species, would appear to be longer than among the other representatives of the genus.

The tomb-bats are found in Africa, India, Burma, the Malayan region, and Australia, but are unknown in Polynesia. Most of them are dwellers in caves, fissures in rocks, and old buildings; but one Indian species has been observed on the stem of a palm tree. Perhaps the best known species is the naked-bellied tomb-bat (*Taphozous nudiventris*), readily recognized by its tawny fur and the naked under parts. It is a large species, measuring three and three-fourths inches in length, exclusive of the tail, the span of the wing being about twenty inches. This species is widely distributed over Africa, and is the one found in the Egyptian tombs, while it also extends into Syria and Palestine. According to Canon Tristram, the caves near the Sea of Galilee are inhabited by clouds of these bats.

Writing of the Sumatran species (*T. affinis*), Mr. E. C. Buxton, as quoted by Dr. Dobson, states that at Telok Betong, in Sumatra, "there was an old, hollow cocoanut stump in the garden, and about twenty of these bats lived in it. At night, or rather early in the morning, they used to hang at the top of the veranda in company with several other kinds; and I found that they were all fruit eaters, as there was a great deal of fruit refuse under them." Although, as Dr. Dobson remarks, this by no means proves the tomb-bat to be at times a fruit eater, as, for all we know, the fruit refuse might have been deposited by its companions, yet that this is probably the case is indicated by the partially frugivorous habits of some of its American allies. The tail of the tomb-bats perforates the membrane between the legs near its centre, and thus has the tip freely projecting. At the will of the animal it can, however, be withdrawn almost completely within the membrane, which thus forms a kind of sheath.



HEAD OF TOMB-BAT.
(After Dobson.)

THE WHITE BATS

Genus *Dididurus*

As white is a color but rarely met with among the Chiroptera, we cannot pass over the white bats, which are represented only by two species from Central and South America. These bats are allied to the tomb-bats, but have three pairs of lower incisor teeth, and they are also distinguished from other bats by the presence of a peculiar pouch on the under side of the membrane between the legs. The typical white bat (*Dididurus albus*) has the fur on the body dark at the base, but the greater portion of each hair, up to the tip, is of a yellowish or creamy white, while the whole of the wing membranes are pure white. The first known specimen was found in Brazil reposing between the fronds of a cocoa palm. If this be the normal habitat of the species, its coloration may perhaps be a protective one, adapted to resemble the silvery hue of the under surface of the palm leaves. Here it may be mentioned that albino varieties of dark-colored bats are occasionally met with; the most recently described example that has come under our notice being a white specimen of a species of *Vesperugo* (*V. capensis*), obtained in 1890 near Cape Town.

THE HAIR-LIPPED BATS

Genus *Noctilio*

If the white bats are noteworthy on account of their color, the two species of hare-lipped bats, which are likewise Central and South American forms, are deserving of mention an account of the curious superficial resemblances of their muzzles to those of the Rodents, while at least the ordinary species (*Noctilio leporinus*), which has been known since the time of Linnæus, is not less remarkable from the peculiar nature of its diet. These bats derive their ordinary name from their curiously folded upper lip, which is bent upwards in the middle line in the form of an inverted V, terminated above by the nostrils. The feet and claws are remarkable for their large size. They have 28 teeth, of which there are $\frac{2}{3}$ incisors, and $\frac{4}{3}$ cheek-teeth on each side. The first, or innermost pair of upper incisor teeth, are of great size, and placed close together so as to conceal the small outer pair; and as the large ones bite against the single smaller pair of lower incisors, the resemblance to the mouth of a small Rodent, such as a mouse, is very striking.

These bats appear to be almost omnivorous in their diet. That they would freely eat cockroaches was proved long ago by Mr. P. H. Gosse, when in Jamaica; and it was at the same time shown that they would chew, although not swallow, the flesh of small birds. In 1859, a Mr. Fraser, writing from Ecuador, stated that they had a very peculiar and offensive fishy smell, and that he had observed them "skimming the bank of the river, every now and then making a dash along, and actually striking the water, catching the minute shrimps as they pass up stream." It was not, however, till 1880, that it was definitely known that they actually caught and fed upon small fish. Professor M'Carthy, who made special investiga-

tions to determine the truth of their alleged fish-eating habits, writes to Mr. J. E. Harting, that in December 1888 he visited a cave in an island near Menos. "This cave is in a soft shale formation, and the top of the opening is about seven feet from the water at full tide. The bats were then in an active state, and the majority appeared to be flying homewards. There were few fish near the surface of the water, and comparatively little local fishing appeared to be going on. An occasional 'swish' now and again far out proved that the bats were trying to secure their prey. Five homeward-bound specimens were secured in the cave, about twelve yards from the mouth. The stomach of one specimen opened within half an hour contained much fish in a finely divided and partially digested state. On the morning of the thirty-first I visited the cave from which the specimens were procured at 3 A. M., and found that the bats had apparently forgotten the previous disturbance. They came flying in in dozens, and two specimens were secured. Both contained considerable quantities of fish. I have opened several other specimens of these bats, and in the majority of cases fish scales were found; but the stomachs of two were perfectly empty. This might be attributed to the absence of the desired fish in the locality."

THE LONG-TAILED BAT

Genus *Rhinopoma*

The last, and at the same time not the least, noteworthy member of the present subfamily, is the long-tailed bat (*Rhinopoma microphyllum*), which is found from Northeast Africa, through India, to Burma. It has 28 teeth, of which $\frac{1}{2}$ on each side belong to the incisor, and $\frac{2}{3}$ to the cheek series. Its most distinctive feature is, however, its very long and slender free tail, which projects far beyond the margin of the very short membrane between the legs, and thereby distinguishes it at a glance from all other bats. It is further quite peculiar in that the second or index finger of the wing has two joints. Another feature of less import, although that which has given the scientific name to the genus, is the presence of a fleshy prominence on the muzzle, just over the nose; this prominence having been incorrectly regarded as a rudimentary nose-leaf. In specimens taken in India during the cold season, there is an enormous accumulation of fat around the tail and thighs, which is sometimes so large as to exceed the weight of the rest of the body; the accumulation being similar to that already noticed as occurring in the naked-bellied tomb-bat and doubtless serving the same purpose. According to Mr. Blanford, "this species is common in Northwestern India, and hides during the day in caves, clefts in rocks, old ruins, and similar places. In Cutch it takes up its abode in wells. Jerdon relates that in Madras, in 1848, many were captured in a house for three successive nights, having probably been blown by strong westerly winds from the rocky hills to the westward. The species is not of common occurrence in Madras. According to Blyth, this species formerly abounded in the Taj at Agra (it may still be found there), and Cantor found numbers inhabiting the subterranean Hindu place of worship within the fort at Allahabad."



LONG-TAILED BAT.
(Natural size.)

THE MASTIFF-BATS

Genus *Molossus*

With the mastiff-bats, which take their name from a supposed resemblance of their broad wide-mouthed muzzles to the head of a mastiff, we come to the first representatives of the second subfamily of this division, the members of which are characterized by the thickness of their tails, which (with a single exception) are prolonged for a considerable distance beyond the hinder margin of the membrane between the hind legs. The legs are short and strong, and the feet of great relative width; while the thumbs of the wings have curious callosities at their bases; and the upper incisor teeth are of large size, and limited to a single pair. As in all these bats, the feet are completely free from the wing membranes, which can be comfortably folded up and stored away between the fore-arms and the legs, and the membrane between the legs can be retraced to a greater or less extent by being moved backwards and forwards along the tail. In the strength of their limbs, in the development of the corn-like callosities at the bases of their thumbs, as well as in their large and



HEAD OF MASTIFF-BAT.
(From Dobson, *Proc. Zool. Soc.*, 1878.)

flat feet, and the freedom of their feet from the wing membranes, the mastiff-bats and their allies are more adapted for crawling on the ground than any other members of this group of animals. And the result of observations on living specimens has been to confirm these inductions, made upon the evidence of structural peculiarities.

The mastiff-bats are an American group, found in the tropical and subtropical regions of both divisions of the Western Hemisphere. With the exception of two species, in which the number of the lower incisor teeth is reduced to a single pair, they have either 26 or 28 teeth, of which $\frac{1}{2}$ on either side are incisors, while the cheek-teeth number either $\frac{4}{4}$ or $\frac{5}{4}$. The upper incisors are placed close together in the middle line; and the large ears, which have a small tragus (occasionally absent) are united by their inner margins. In common with two nearly allied genera of bats, they have very capacious lips, which in most of the species are thrown into a number of wrinkles or puckers; and they are further characterized by their long and slender wings. The great length and narrowness of the wings indicate, as Dr. Dobson observes, rapid flight; and since they also possess the power of varying the length of the membrane between the legs by a "reefing" process, they must have great dexterity in suddenly changing their direction, as when they are compelled to double in pursuing swiftly flying insects; and, again, their expansive and capacious lips aid the teeth in seizing and retaining the round and solidly-armored bodies of the larger beetles; so that it would seem that they are better adapted than any other members of the order for capturing insects of very swift flight.

Of the red mastiff-bat (*Molossus rufus*) an account is given by Mr. P. H. Gosse, from which it appears that this bat inhabits the roofs of houses and the hollow trunks of palm trees, where colonies of large size may sometimes be found. It is more active when on the ground than any other species; and, indeed, on such occasions its motions are so rapid that some dexterity is required to ensure its capture. In the act of running it rests on its wrists, with the fore part of the body considerably raised. In the hollow stem of a palm tree, examined by another observer, it was found that while in one place the males of this species were collected together to a number approaching two hundred, in another spot the assemblage consisted almost entirely of females, with only a solitary male among them here and there. This distinction of the resting places of the two sexes has also been noticed in certain other bats.

In describing the habits of another species, the chestnut mastiff-bat (*M. glaucinus*), Mr. Gosse writes that "soon after sunset we hear the scrambling of little claws along the plaster (in the loft above) gradually tending towards the point where the holes under the eaves is situated. . . . I judge that they crawl along one after another in a straight line to the outlet, in parties. The family assured me that after the mastiff-bats had emerged a few hours, they invariably returned into the hole again; and they several times directed my attention to them when returning. They return between eight and nine o'clock, and issue forth again before the morning twilight. When handled, its impatience of confinement is manifested by a continuous screeching, not very loud, but exceedingly harsh and

shrill. The ears are commonly so pendent as completely to cover the eyes; but they are occasionally retracted so as to expose the eyes, especially if the face be touched."

In certain parts of the Amazon valley the mastiff-bats, together with some species belonging to the under mentioned nose-leaved family, are so numerous as to become a serious inconvenience to travelers. Thus when at Caripi, a station situated about twenty miles from Para, Bates narrates how for the first few nights of his stay he slept in a room with the roof open to the tiles and rafters, which had not been used for many months previously; and on the second night of his visit was awakened about midnight by the sudden rushing of swarms of bats flying around him. So numerous were they, that the air was alive with them; the lamp had been extinguished by the rush of their wings, but when relighted revealed the whole room blackened by their multitudes. The traveler proceeded to clear them out by laying about vigorously with a stick, and for a time succeeded in making the unwelcome intruders retire to the tiles and rafters. No sooner, however, was quiet restored than the bats reappeared in full force, and once more extinguished his light. On the third night several of the bats got into his hammock, and crawled over him; these were seized and dashed against the wall. In the morning he was unpleasantly reminded of the nocturnal visitation by finding that he had a wound on the hip, evidently caused by the bite of a bat. Being thereby roused to desperation, he set to work in real earnest to mitigate the nuisance. A large number were shot as they clung to the rafters, while the negroes ascended the roof from outside by means of ladders, and succeeded in routing out hundreds of them from beneath the eaves, among which were several broods of young ones. Although there were altogether four species of bats present on this occasion, one of which belonged to the genus *Phyllostoma*, another to *Glossophaga*, and two to the present genus, by far the greater majority pertained to the large-eared mastiff-bat (*M. perotis*), characterized by the great size of its ears, and having a span of wing of two feet. It was these bats which crawled over Mr. Bates while in his hammock; but it was the *Phyllostoma* (of which more anon) that appears to have inflicted the wound.

THE NAKED BAT

Genus *Chiromeles*

One of the ugliest and strangest of all the Chiroptera is the naked or collared bat (*Chiromeles torquatus*), of the Malayan region, which is a large species, measuring five and one-fourth inches in length, exclusive of the tail. The total number of its teeth is 26, of which $\frac{1}{2}$ are incisors, and $\frac{4}{5}$ are cheek-teeth on each side. With the exception of a collar of thinly-spread hairs, nearly surrounding the neck, the thick and puckered skin is almost completely naked. The great toe is longer than all the others, to which it can be opposed; the ears are not joined together, the lips are smooth, and the tail is very long and thick, with more than half its length freely projecting beyond the hinder border of the membrane between the legs.

The most curious feature about this repulsive-looking animal (in which, by the way, the muzzle is long and pig-like) is, however, the presence of a deep pouch on the under side of the body below the arm pits. These pouches, which occur in both sexes, are for the purpose of containing the young during the period of suckling; and are absolutely necessary, since in their absence the young would be quite unable to cling to the naked body of the parent. Since these pouches are present in the males as well as the females, Dr. Dobson suggests that in cases where there are twins the male parent may relieve his mate of the task of carrying one of the offspring; instances of a similar division of labor being believed to occur among the fruit-bats.

This bat, which is figured in the illustration on p. 246, occurs in the larger islands, such as Java, Sumatra, and Borneo, of the Malayan region, where it dwells in the heart of the densest forests. During the day its place of repose may be either a hollow tree, or a cleft in the rocks, or even a hole in the ground. Its flight, which is heavy and slow, commences as soon as the sun reaches the horizon, and takes place in the openings and glades of the forests, or even high up in the air in the open plains,



HEAD OF FEMALE OF THE NAKED BAT.
(After Dobson.)

THE WRINKLED-LIPPED BATS

Genus *Nyctinomus*

By far the most abundant in species of the bats of this group, as well as the most widely spread, are the wrinkled-lipped bats of the warmer regions. While closely allied to the mastiff-bats, they are distinguished by the upper incisor teeth being separated from one another in the middle line, and also by the much greater development of the vertical wrinkles on the capacious lips. The ears are generally more or less extensively united at their bases, and the number of teeth varies from twenty-eight to thirty-two. One member of the genus, Ceston's bat (*Nyctinomus cestoni*), is the solitary representative of the whole family found in Europe, where it extends as far northward as Switzerland. This species measures nearly three and one-half inches in length, exclusive of the tail, but most of the others are smaller. Ceston's bat has the peculiar power of being able to sink its eye within the socket; and then to protrude it again. It has, perhaps, the widest range of all the species, occurring not only in the south of Europe, but also in Egypt, Nubia, Amoy, and China. The late Mr. Swinhoe, writing of this species, observes: "I have often on a cloudless evening, at Amoy, seen these bats flying along, high in the air, being easily distinguished by the narrowness of their wings. When watched, the creature

has a habit of exposing its tail, and of sinking its eye into the socket and thrusting it out again. The membrane extending from the tail to the legs is wrinkled, and covers the tail like a glove, so as to slip up and down as the creature wishes to expand or contract its interfemoral wing, or, in nautical language, to shake out or take in reefs." The tail cannot, however, be completely withdrawn into the membrane, in the manner of the tomb-bats.

Two species are found in India, two in Australia, and New Guinea, and four in America, but the majority are restricted to Africa south of the Sahara and Madagascar. The Indian species are generally found during the day in caverns and old buildings, countless myriads inhabiting the limestone caves of Phagat, thirty miles from Moulmein, in Burma. And it is probable that the habits of most of the other species are very similar.

Writing from Jamaica of the habits of the Brazilian wrinkled-lipped species (*N. brasiliensis*), Mr. W. Osburn observes: "Vast numbers of these little bats inhabit the shingled roof of my house. . . . I have often observed them during the day, exactly as Goldsmith's line expresses: 'lazy bats in drowsy clusters cling'; for, what seems surprising, notwithstanding the heat of the situation, shingles exposed to the sun (and it was disagreeably hot and confined where I stood, twelve or fifteen feet below), the bats clung in complete clusters. I counted fourteen little heads in a mass about the size of a turnip. But they are not all asleep; now and then a wing is stretched out with drowsy enjoyment; and the luxury King James thought too great for subjects, and which ought to be reserved for kings, is largely indulged in by these bats. First one and then another wakes up, and withdrawing one leg, and leaving himself suspended by the other alone, adroitly uses the foot at liberty as a comb, with a rapid effective movement dressing the fur of the under parts and head — an action far from ungraceful. The foot is then cleaned quickly with the teeth or tongue, and restored to its first use. Then the other leg does duty. Perhaps the hairs with which the foot is set may aid to this end. I often have seen them do this in confinement, and probably the numerous bat-flies with which they are infested may be the cause of extra dressing."

THE NEW ZEALAND BAT

Genus *Mystacops*

That New Zealand, with its far more favorable climate for these animals than the British Isles, should possess only two species of bats is a very remarkable fact. One of these (*Chalinolobus tuberculatus*), belonging to a genus closely allied to *Vesperugo* (p. 274), is common to New Zealand and Australia; while the second is peculiar to the colony, and represents a distinct and aberrant group of the family under consideration.

The New Zealand bat (*Mystacops tuberculatus*) differs from the other members of the family *Emballonuridae* in that the third or middle finger of the wing is provided with three distinct bony joints; of which the first, when at rest, is folded

back beneath, instead of above, its supporting metacarpal bone. Moreover, while the greater part of the wing membranes is very thin, the portion along the sides of the body and the lower moieties of the limbs is much thickened; beneath this thickened portion the remaining parts of the wings lie folded away as if in a case; and in this condition this species is better adapted for a crawling or climbing life than any other member of the order. There are other peculiarities adapted to aid in climbing, connected with the thumb, feet, and legs. The length of the head and body is two and one-half inches; and the general color of the upper parts is brown, though beneath they are paler. Even the fur of this bat can, under the microscope, be at once distinguished from that of all other species; the individual hairs being very thick, and with only faint traces of the projecting scales characteristic of other bats. The tail is extremely short. From its structural peculiarities Dr. Dobson is led to believe that this curious bat hunts for its insect food, not only in the air, but also on the branches and leaves of trees, among which it would certainly be able to creep with ease.

THE VAMPIRE-BATS

Family *PHYLLOSTOMATIDÆ*

The extensive group which it is convenient to allude to collectively under the name of vampires, is exclusively confined to Central and South America and the West Indian islands. While related to the preceding family, with which they agree in the characteristics mentioned on p. 291, they differ in certain other points of importance. And they appear to have a relationship to the smooth-nosed free-tailed bats (*Emballonuridæ*) similar to that presented by the leaf-nosed bats (*Rhinolophidæ*) to the typical bats (*Vespertilionidæ*).

They are characterized by the presence of three bony joints in the third or middle finger of the wing, accompanied either by a well-developed nose-leaf, or by folds of skin and warts on the chin. Such of them as have a nose-leaf (and these are by far the greater majority) may be always distinguished from the leaf-nosed and horseshoe-bats, not only by the number of joints in the third finger, and by the characteristics mentioned on p. 291, but likewise by the presence of a distinct tragus to the moderate-sized ears. Moreover, if we examine the dried skulls of any members of the two families, we shall find that while in the leaf-nosed bats and their allies the premaxillary bones, in which the one pair of small upper incisor teeth are implanted, are small, separate, and loosely attached to the skull, in the vampires these bones are large, firmly united both to one another and the skull, and generally carry two pairs of large incisor teeth.

The number of genera and species of vampires is so great that only the more remarkable types can be even mentioned in this work. With the exception of a few species having well-developed tails and a large membrane between the hind legs, which are of strictly insectivorous habits, the vampires are remarkable for the varied nature of their food; some subsisting on a mixed diet of insects and fruits, others being wholly frugivorous, and a few exclusively bloodsuckers. Others again,

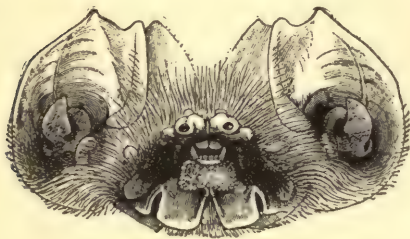
although there has been, and still is, considerable doubt on the matter, appear to vary their ordinary diet by resorting to blood sucking when occasion occurs. All are of purely ærial habits, and present none of the adaptations for crawling which characterize the mastiff-bats and their allies. They appear to be limited to the forest-clad districts of the regions they inhabit; and, according to Dr. Dobson, do not probably extend much farther south than the thirtieth parallel of latitude. That they are a highly specialized family is apparent both from their structure and the peculiar habits of many of their representatives. In South America the name vampire is applied indifferently to several members of the family—a circumstance which has been the fruitful source of confusion among European writers.

THE CHIN-LEAFED BATS

Genera *Chilonycteris* and *Mormops*

Two genera, the one containing six and the other two species, differ from the other members of this family in the absence of a nose-leaf, the function of which is

performed by folds or lappets of skin depending from the chin. These bats may consequently be called chin-leafed bats. They are of small size, the largest only measuring two and one-half inches in length, exclusive of the tail. The two species belonging to the genus *Mormops* are distinguished from those included in the genus *Chilonycteris* by the great elevation of the crown of the head above the line of the face, as shown in our illustration. While most of the species are dull colored, Blainville's chin-leafed bat (*Mormops blainvillei*) is remarkable for the bright



HEAD OF BLAINVILLE'S CHIN-LEAFED BAT.

(From Dobson's *Catalogue of Bats in the British Museum*.)

orange hue of its fur; and it is also remarkable for its extremely fragile structure, the head being so delicately formed that light can actually be seen through the roof of the open mouth.

THE HARMLESS VAMPIRES

Genus *Vampirus*

We take as our first example of those having a nose-leaf, the well-known great vampire (*Vampirus spectrum*). It belongs to a group of the family in which the tail, when present, perforates the membrane between the legs. The nose-leaf, as in most members of the family, is spear shaped, whence the name of spear-nosed bats, frequently applied to all the vampires. The great vampire, according to Bates, is abundant in many parts of the valley of the Amazon, such as the neighborhood of

Ega; and it is the largest of all the South American species, measuring twenty-eight inches in expanse of wing. "Nothing in animal physiognomy can be more hideous than the countenance of this creature when viewed from the front,—the large leathery ears standing out from the sides and top of the head, the erect spear-shaped appendage on the tip of the nose, the grin, and the glistening black eyes,—all combining to make up a figure that reminds one of some mocking imp of fable. No wonder that some imaginative people have inferred diabolical instincts on the part of so ugly an animal. The vampire is, however, the most harmless of all bats, and



THE GREAT VAMPIRE-BAT.
(One-fourth natural size.)

its inoffensive character is well known to residents on the Amazon. I found two distinct species of it, one having the fur of a blackish color (*V. auritus*), the other of a ruddy hue (*V. spectrum*), and ascertained that both fed chiefly on fruits. The church at Ega was the headquarters of both kinds. I used to see them, as I sat at my door during the short evening twilight, trooping forth by scores from a large open window at the back of the altar, twittering cheerfully as they sped off to the borders of the forest. They sometimes enter houses. The first time I saw one in my chamber wheeling heavily round and round, I mistook it for a pigeon, thinking

that a tame one had escaped from the premises of one of my neighbors. I opened the stomachs of several of these bats, and found them to contain a mass of pulp and seeds of fruits, mingled with a few remains of insects. The natives say they devour ripe cajus and guavas on trees in the gardens; but on comparing the seeds taken from their stomachs with those of all cultivated trees of Ega, I found they were unlike any of them. It is therefore probable that they generally resort to the forest to feed, coming to the village in the morning to sleep, because they find it more secure from animals of prey than their natural abodes in the woods."

It will be observed that Mr. Bates speaks of the great vampire as *the vampire*, but, according to Dr. Dobson, this title is more properly applicable to the blood-sucking vampires noticed below. While the great vampire is entirely without a tail, the lesser vampire (*V. auritus*) has a small rudiment of that appendage. The latter species serves to connect the former with an allied genus of bats known as *Lophostoma*, in which the nose-leaf is narrower in front, and the chin has a central naked space marked by small warts. It also shows resemblances to the javelin-bats, mentioned on this page, in the presence of a glandular opening near the top of the breastbone.

THE JAVELIN-BATS

Genus *Phyllostoma*

Omitting mention of several allied genera, we come next to the javelin-bats, of which there are three species. These are distinguished from the harmless vampires by the much shorter and broader muzzle, and also by the presence of two (instead of three) premolar teeth on each side of the lower jaw.



THE JAVELIN VAMPIRE.

The common javelin-bat (*Phyllostoma hastatum*) measures just under four inches in the length of head and body, and is next in point of size to the great vampire. Its general color is usually dark grayish, or reddish brown above, and paler beneath, but sometimes the upper parts are of a brilliant chestnut brown. The other two species are much smaller, measuring only three inches, or a fraction more, in length of head and body. All are found in Brazil, and they generally rest in the trunks

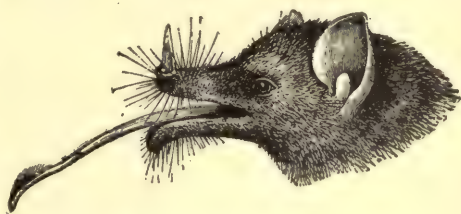
of hollow trees, or beneath the leaves of palms. They have been accredited with blood-sucking propensities, and although Dr. Dobson seems disinclined to accept this view, yet the testimony of several observers inclines us to believe that the indictment is true. We have already alluded to Mr. Bates's account of his being wounded during the night by a bat which he refers to the present genus; and in the same passage he observes that "the fact of their sucking the blood of persons sleeping, from wounds which they make in the toes, is now well established; but it is only a few persons who are subject to this blood-letting. According to the natives, the *Phyllostoma* is the only kind which attacks man." The latter part of the statement makes this testimony the less convincing, since there is no doubt but that the blood-sucking vampires mentioned below are the species which most generally and habitually attack Mammals. That the bat caught by Mr. Bates was a javelin-bat, or an allied form, is evident from his allusion to the large size of the nose-leaf; and thus the only way in which his statement could be disproved would be by assuming that, while a true blood-sucking vampire was the real culprit, the javelin-bat was the one caught and charged with the attack.

Mr. Wallace's testimony, as given in his *Travels on the Amazon*, is very similar to that of Mr. Bates's; the javelin-bats being here also the ones charged with blood sucking. In a later work (*Tropical Nature*), Mr. Wallace indeed speaks of the bats charged with this crime as having their tongues armed at the tip with horny papillæ — which would seem to point to the under-mentioned long-tongued vampires, whose food is insects and fruit. He alludes, however, in both places to the blood-sucking bats as javelin-bats; and although there is evidently some confusion in regard to the tongue question, it is difficult to believe that two independent observers should have been so deceived as to charge members of one group of bats with an attack committed by those of another.

THE LONG-TONGUED VAMPIRES

Genus *Glossophaga*, etc.

A group of several genera of rather small or medium-sized bats are at once distinguished from the other members of the present family by their long and narrow muzzles, and their slender, elongated tongues, which can be protruded for a considerable distance beyond the mouth. At their extremities these tongues are armed on the upper surface with a number of long, thread-like papillæ; and it was long considered that these papillæ were employed for abrading the skin of animals previous to the process of blood sucking. It now appears, however, that their use is either to extract the soft pulp from the interior of hard-rinded fruits, or to lick out insects from the tubes of



HEAD OF LONG-TONGUED VAMPIRE.
(*Cheronycteris*.)
(From Dobson.)

flowers. That some of the species feed on fruits has been ascertained by direct observation; but the discovery of the remains of insects in the stomachs of others proves that the diet of all is not of the same kind. One of the species which is known to feed on insects is the Soricine long-tongued vampire (*Glossophaga soricina*), and since this species has a well-developed membrane between the hind legs, while in some of those subsisting entirely on fruit the same membrane is very short, Dr. Dobson considers that we may predicate the nature of the food of any given species by the size of this membrane. The species with the longest tail membrane will be the best flyers, and consequently those best suited for the capture of insects.

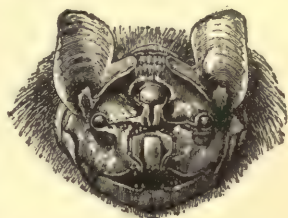
Writing of Sezekorn's long-tongued vampire (*Phyllonycteris sezekorni*), of which some individuals were taken from a large colony in a cave in Jamaica, Mr. Osburn describes their mode of feeding on the fruit or the so-called clammy cherry: "The tongue was rapidly protruded and drawn in again, and the juice and softer pulp cleared away with great rapidity. I noticed he was very particular in clearing out the bit of loose skin of berry, and licked my fingers clean of the juice spilt on them, carefully cleaning out any that had collected under the nail. I then got another berry. The bat was hanging against the edge of the box, its under surface against the side; and as I held the berry a little distance off to see the action of the tongue, it had, whilst feeding, to bend the neck so as to raise the head a little; this seemed to fatigue it. It therefore raised itself on one wrist, and turned round so that its back was against the box's side; but as it did not change the position of the feet, of course the legs crossed, the right foot now being on the left side, and *vice versa*. In this odd position it appeared perfectly at ease, and went on licking at a fresh berry with great relish. As the pulp and juice became exhausted I expected the bat would drop it, and was prepared with another berry; but to my surprise, he brought up the wrists to the muzzle, took the berry between them, gave it two or three energetic bites, and then held the berry off. So I now understood what the unusually long thumbs were for; for they applied themselves dexterously to the berry, held it firmly, and then, as it appeared to me, by a reverse action of the two wrists the berry was turned round, a fresh hold taken by the teeth, and the same licking process renewed till the seed in the centre was cleaned of the pulp, all but the little bit which served for the last tooth-hold. It was then dropped, and the eager little muzzle raised for more."

THE SHORT-NOSED VAMPIRES

Genus *Artibeus*, etc.

The short-nosed vampires comprise a group of nine genera, all the members of which are mainly of frugivorous habits. These bats may be easily recognized at sight by their very short and generally wide muzzles, furnished with a short nose-leaf, of which the front portion is horseshoe shaped, and the hinder part spear like. The membrane between the hind legs has its hinder margin excavated to form a

hollow curve; and there is no trace of a tail. Two of the best known species are *Artibeus planirostris* and *A. perspillatus*, the former of which was regarded by Charles Waterton as the veritable blood-sucking vampire. The latter is abundant in the caves of Jamaica, and feeds on bread-nut, mangoes, and other fruit; it measures three and one half inches in length, and, with its allies, may be considered in South America to take the place of the fruit-bats of the Old World. These bats fly early in the evening, and are in the habit of reposing during the day in places exposed to a considerable amount of light, having been observed beneath the eaves of a house in Demerara with the rays of the setting sun shining full on them. In other places they have been found roosting in large clusters beneath the fronds of the cocoa palm. Of another Jamaica species (*Stenoderma achradoophilum*) Mr. P. H. Gosse remarks that it "feeds on the fruit of the naseberry. About a quarter of an hour after the sun has set, and while the sky is still glowing with effulgent clouds, these bats begin to fly round the tree. . . . On picking up a fruit you find that it has been just bitten and nibbled in a rugged manner. Fragments of naseberry of considerable size, partly eaten by a bat, are frequently found at the distance of half a mile from the nearest naseberry tree." The centurion bat (*Centurio senex*), of which the head is represented in the accompanying illustration, differs from all the members of this group by the absence of a distinct nose-leaf. Owing to the remarkable foldings of the skin, the face of this bat presents a most grotesque appearance.



HEAD OF CENTURION BAT.
(From Dobson.)

THE BLOOD-SUCKING VAMPIRES

Genera *Desmodus* and *Diphylla*

The two species of blood-sucking vampires, each the solitary representative of a distinct genus, with which we close our account not only of the vampires, but also of bats generally, present the following distinctive characteristics:

Firstly, they may be recognized by their very short and conical muzzles, surmounted by a small though distinct nose-leaf; as well as by the shortness of the membrane between the hind legs, and by the total absence of a tail. Secondly, they are characterized by the fewness and peculiar structure of their teeth; of which the total number is only twenty in one species, and twenty-four in the other. In the former there are no molar teeth, although a small rudimentary one is present on each side of the jaws of the latter. In the upper jaw there is a single pair of very broad-crowned incisors, which fill up the whole of the space between the tusks or canines, and have keen and sharp-cutting edges like chisels. The premolar teeth, of which there are two pairs in the upper and three in the lower jaw, have likewise trenchant cutting edges working against one another, and being quite unlike those of any other bat. When we add to these characteristics the sharp tusks with which each jaw is provided, it will be evident that the teeth of the blood-sucking

vampires must be specially adapted for some particular purpose—that purpose being blood-letting.

It is not by any means only in their teeth that these bats are adapted for their mode of sustenance, the structural modification also extending to their internal organs. Thus, whereas in other bats the stomach has the usual subglobular form common to Mammals in general, in the blood-sucking vampires it becomes an elongated organ of a tube-like form; blood naturally requiring little or no process of digestion before being absorbed into the tissues of the animal by which it has been swallowed.

The common blood-sucking vampire (*Desmodus rufus*) is a comparatively small-sized bat, measuring only about three inches in length, and of a reddish brown color above, and usually some shade of yellowish brown beneath. It has no true molar teeth, and likewise no spur on the ankle for the support of the membrane between the legs. The geographical range of this species is large, extending from Central America to Southern Brazil on the east of the continent, and to Chili on the west.

The smaller blood-sucking vampire (*Diphylla ecaudata*) serves to connect the common species with the other members of the family, having a small rudimentary upper molar tooth on each side of both jaws, and also a tiny spur on the ankle. It is further distinguished by the middle portion of the membrane between the hind legs being quite undeveloped, as well as by certain features connected with the lower incisor teeth, which are peculiar in having distinct notches on the summits of their crowns. The color of this bat is very similar to that of the common species; but the size of the animal is slightly less. This smaller vampire, which appears to be confined to Brazil, is stated to be far from common; and we have not met with any account of its having been caught in the act of blood sucking, although there can be no doubt that this is its constant habit.

During the daytime these bats repose in caves or hollow trees, whence they issue forth for their nightly blood sucking. It appears that when they have selected a victim for attack, they either settle down on or hover over the part to be operated on; and then proceed to shave away a thin portion of skin by a razor-like action of the sharp upper incisor teeth, by which the blood is caused to ooze from a number of the small capillary vessels, and is then sucked up by the mouth and swallowed. From their structure, it is probable that blood constitutes their whole diet.

The fact that certain bats in South America were veritable blood suckers has been long known; our first information dating from a period soon after the conquest of that country. Great uncertainty prevailed, however, for a lengthened period as to which particular species of the large family of vampires were the real culprits; and the question was not finally decided till, during the voyage of the "Beagle," Mr. Darwin had the good fortune to see a *desmodus* caught in the very act. His account has been quoted over and over again, almost *ad nauseam*, and we shall refrain from repeating it here; merely mentioning that the bat in question—which was the common blood-sucking vampire—was caught by one of the great naturalist's servants actually sucking the blood from the withers of one of the

camp horses. Thus was set at rest forever the long vexed question as to which was the true blood-sucking vampire. It may be observed, however, that whereas it is now certain that the present group is the only one of which the members subsist entirely on a diet of blood, yet it is possible that, as already mentioned, some of the javelin-bats or their allies, may, on occasions, vary their ordinary food with it.

FOSSIL BATS

From the exigencies of space our account of the bats has been somewhat brief; but it may serve to show what an extensive assemblage of animals it really includes, and how different from one another in habits, as well as in details of structure, are many of its members, though all bats agree very closely in their general plan. This conformity to a common structural standard is as fully characteristic of the few fossil bats with which we are at present acquainted, as it is of their modern allies; the whole of them belonging to living families, and a large proportion to existing genera. At the comparatively early period when the Upper Eocene strata of the Paris basin were deposited, leaf-nosed bats, as well as typical bats nearly allied to the living noctule, had already come into existence, and have left their remains buried in the rocks alongside those of strange extinct hoofed Mammals, such as the *Palæotheres* and *Anoplotheres*. And it is, therefore manifest that if we ever succeed in discovering the ancestral forms from which bats have been derived, it will be in rocks of far greater age than those of the Paris basin, which belong to the lower portion of the Tertiary period of geological history. It is, indeed, within the bounds of probability that bats have existed as such from a period as remote as the one during which the English chalk was deposited on the floor of an ancient ocean.

CHAPTER XII

THE INSECTIVORES—ORDER INSECTIVORA

THE absence of any vernacular name for that group of Mammals, of which the shrews, moles, and hedgehogs are the best known representatives, compels us to adopt an anglicized form of the Latin term by which the group is known; and we accordingly use the term Insectivores in this sense. This term, it is almost superfluous to add, refers to the insect-eating habits of most of the members of this order, and it is a good one, since, with the exception of the bats, there is no other group of Mammals which prey so exclusively on insects, or other small creatures.

Most of the Insectivores are comparatively small-sized animals; and, with the exception of the family of tree-shrews, and some of the aquatic forms, all are of more or less purely nocturnal habits. In the absence of any very strongly-marked characteristics, like the wings of the bats, the group is by no means easy of strict definition,—more especially when we have to avoid entering into the consideration of abstruse anatomical details.

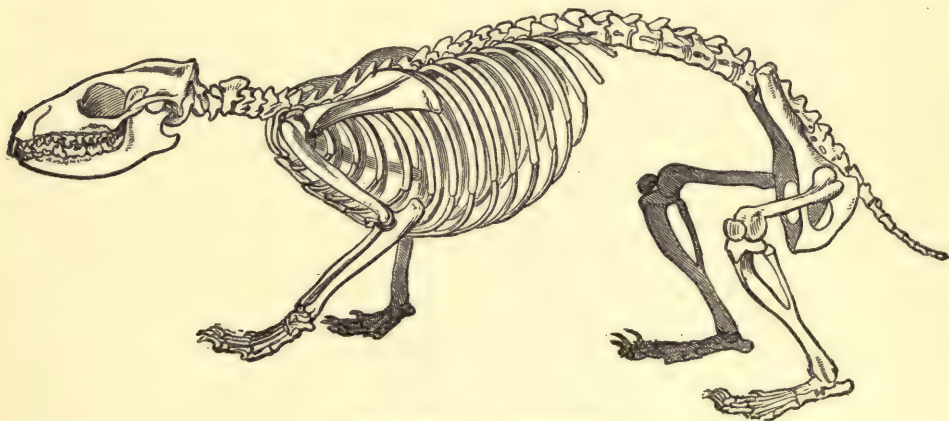
Character-istics In addition to their generally small size and nocturnal habits, the Insectivores may immediately be recognized by the following structural features. All their toes are furnished with claws, and are in most cases five in number on each foot; while in no instance is either the thumb or the great toe capable of being opposed to the other digits. They walk either on the whole, or the greater portion, of the soles of their feet; and never on their toes only, in the manner of a cat or dog. Their upper molar teeth carry a number of small and sharp cusps, which are arranged either in a V-shaped or a W-shaped pattern; and their incisor teeth, of which there are not less than two pairs in the lower jaw, never assume the chisel-like form found in all the Rodents (rats, porcupines, hares, etc.); but the first or innermost pair is very frequently larger than either of the others, thereby distinguishing them from the Carnivores. In no instance is one pair of the cheek-teeth in each jaw ever modified so as to act with the scissor-like action characteristic of so many of the Carnivores. Then again the tusks, or canine teeth, are generally not markedly distinct from the other teeth,* so that it is frequently a matter of some difficulty—especially in the lower jaw—to decide which teeth are incisors, which tusks, and which premolars. This may be readily verified by comparing the skull of a hedgehog with that of a dog, in which the tusks cannot possibly be confused either with the incisors in front, or with the premolars behind.

If, again, we examine the skeleton of an Insectivore, it will be found that there are (with the single exception of one peculiar African species) always a pair of complete collar bones, or clavicles connecting the bladebones (scapula) with the

* This is not so in the common tenrec, which has large tusks.

breastbone, by which the order is at once distinguished from the Carnivora. Externally, the Insectivores are very generally characterized by their very long and narrow snouts, in which the muzzle is produced considerably in advance of the end of the lower jaw; while their bodies are covered either with fur, or, more rarely, with a protecting armor of spines. On opening the skull it will be found that the upper surfaces of the lobes of the brain are smooth; and thereby very different from those of a Carnivore.

There are other distinctive characteristics of the order, for the proper appreciation of which a knowledge of anatomy is requisite. If, however, the whole of the points mentioned above receive due consideration, there will be but little fear of confusing an Insectivore with any other Mammal, except it be a Marsupial. The Marsupials, however, as will be shown in the sequel, are broadly distinguished by many important characteristics; while, were it not for the opossums, they would be restricted to the Australian region, in which Insectivores are unknown. Moreover, with the exception of the Virginian species, the opossums are confined to South



SKELETON OF HEDGEHOG.

America, where Insectivores are absent; and there is accordingly not much risk of a living Marsupial being mistaken for an Insectivore, or *vice versa*. In all respects, as is well shown by their small and smooth brains, the Insectivores occupy a very low position in the Mammalian series; and next to the Marsupials and Monotremes of Australia, they may be regarded as more nearly allied to the original primitive Mammalian stock than any other members of the class now existing. Their nearest relatives are the bats, which, as already mentioned, may be regarded merely as Insectivores specially modified for a life in the air. It must not, however, be supposed that any living Insectivore can be regarded as the ancestral form of the bats; such ancestors having totally disappeared ages and ages ago. In other directions indicated by extinct types, it is probable that the Insectivores are allied to the lemurs on the one hand; while on the other, they may have been derived from the Marsupials.

Distribution The Insectivores are widely scattered over the globe, although absent from the two large regions mentioned above. Some of the most curious forms are found in Madagascar, Africa, and the West Indian islands.

The tendency being for low forms to disappear when brought into competition with higher types of animal life, it is interesting to observe that the Insectivores have either survived in islands, like Madagascar or Cuba, where the higher forms of Mammals are few or wanting, or, in the continental areas have acquired habits which serve to protect them from the attacks of foes. For instance, in addition to being strictly nocturnal, which is of itself a great protection, most of the Insectivores live in the depths of forests, or concealed among the stems and roots of coppices and shrubs, or in the deserted holes of other animals; while the moles have taken to a completely subterranean life, and the hedgehogs have acquired a special protection in their coat of thick-set spines. Others, again, like the water-shrews and the desmans, resort to the water, and hide themselves during their periods of repose in holes in the banks of rivers and lakes; while the diurnal tree-shrews seek the protection afforded by a life among the boughs of forest trees, after the manner of squirrels. Finally, the flying cobegos are peculiar in possessing the power of taking flying leaps from tree to tree, and are thus secure during their hours of movement from most enemies except man.

THE COBEGOS OR KAGUANS

Family *GALEOPITHECIDÆ*

Few Mammals have been a greater puzzle to zoologists, as regards their proper systematic position, than the cobegos, colugos, kubongs, or kaguans, of the Malayan region. These animals, of which there are two species, are known to the natives of the regions they inhabit by the names above mentioned, but they are commonly spoken of by Europeans either as flying lemurs or flying bats. They constitute the genus *Galeopithecus* of zoologists, which is the type of a distinct family; and as recent researches have shown that they come nearer to the Insectivores than to any other group, they are now generally regarded as constituting a special division of that order.

The most characteristic external feature of these curious animals is the parachute formed by folds of skin running along the sides of the neck and body, and connected with the long and slender limbs, of which the fingers and toes are webbed as far as the roots of their strong and curved claws. This parachute-like membrane is continued between the hind legs to include the whole of the long tail, in which respect these animals differ from the flying squirrels to be mentioned hereafter. One of their most peculiar features is to be found in the structure of their lower front, or incisor teeth, which are quite unlike those of any other Mammal, or indeed of any animal. In both jaws these incisor teeth are expanded laterally, and compressed from front to back, with a number of cusps on their summits, and those of the lower jaw have very wide, flattened crowns, penetrated by a number of parallel vertical slits, so that they resemble small combs mounted upon narrow stems. Then, again, the outermost of the two pairs of upper incisor teeth, as well as the upper tusk, or canine (which is nearly similar to the incisors), are inserted in the jaws by two dis-

tinct roots. This is a unique feature among living Mammals, although the moles and hedgehogs have two roots to their upper tusks.

Habits The common cobego is found in Sumatra, Borneo, Java, the Malay Peninsula, Tenasserim, and Siam, and is known as *Galeopithecus volans*. It is about the size of a cat; and its habits have been well described by Mr. Wallace, who met with it in Sumatra. He observes that the cobego "is sluggish in its motions, at least by day, going up a tree by short runs of a few feet, and then stopping a moment as if the action was difficult. It rests during the day clinging



THE COBEGO.
(One-sixth natural size.)

to the trunks of trees, where its olive or brown fur, mottled with irregular whitish spots and blotches, resembles closely the color of mottled bark, and no doubt helps to protect it. Once, in a bright twilight, I saw one of these animals run up a trunk in a rather open place, and then glide obliquely through the air to another tree, on which it alighted near its base, and immediately began to ascend. I paced the distance from the one tree to the other, and found it to be seventy yards; and the amount of descent I estimated at not more than thirty-five or forty feet, or less than one in five. This I think proves that the animal must have some power of guiding

itself through the air, otherwise in so long a distance it would have little chance of alighting upon the trunk. The galeopithecus feeds chiefly on leaves, and possesses a very voluminous stomach and long convoluted intestines. The hair is very small; and the animal possesses such a remarkable tenacity of life that it is exceedingly difficult to kill it by any ordinary means. The tail is prehensile, and is probably made use of as an additional support while feeding. The animal is said to have only a single young one at a time; and my own observation confirms this statement, for I once shot a female, with a very small, blind, and naked little creature clinging closely to its breast, which was quite bare and much wrinkled, reminding me of the young of the Marsupials, to which it seemed to form a transition. On the back, and extending over the limbs and membrane, the fur of these animals is short but exquisitely soft, resembling in its texture that of the chinchilla."

A very similar account is given of this species in Java by a much earlier writer, Horsfield, who states that, in addition to leaves, it feeds on the fruits of several trees when in an unripe condition, among these being young cocoanuts. In Java it is said to be "confined to particular districts, where it is met with chiefly on isolated hills, covered with a fertile soil, and abounding with young luxuriant trees, the branches of which afford it a safe concealment during the day. As the evening approaches, it leaves its retreat, and is seen in considerable numbers making oblique leaps from one tree to another; it also discovers itself by a croaking, harsh, disagreeable noise."

Philippine Cobego Of the slightly smaller Philippine cobego (*G. philippinensis*), restricted to the islands from which it takes its name, we have a short account by Professor Moseley in his *Naturalist on the Challenger*. This observer relates how, when on Basilan island—one of the Philippines—he was conducted by a native guide to a particular spot, for the purpose of shooting specimens of this animal. Here "some few trees were standing isolated, not having been as yet felled on the clearing. On one of these, after much search, a kaguan was seen hanging to the shady side of a tall trunk. It was an object very easily seen, much more so than I expected. It moved up the tree with a shambling, jerky gait, hitching itself up apparently by a series of short springs. It did not seem disposed to take a flying leap, so I shot it. It was a female with a young one clinging to the breast. It was in a tree at least forty yards distant from any other, and must have flown that length to reach it. I understood from my guide that numbers of these animals were caught when trees were cut down in clearing. They are especially abundant at the island of Bojol, north of Mindanao; their skins were sold at Zebu, which lies near, at five dollars a dozen."

In their leaf-eating habits the cobegos stand apart from all other Insectivores, in this respect occupying the same relationship to the typical members of the order as is presented by the fruit-bats, to the typical bats. Instead of possessing the power of true flight, characteristic of the bats, the cobego merely enjoys spurious flight, or the power of continuing the extension of an ordinary leap by the aid of its parachute.

It would require but comparatively little further modification to alter a cobego into a creature much resembling a bat, and endowed with the power of true flight;

and we thus gain a good idea of the way in which the bats may have probably been derived from the Insectivores. It must not, however, be thereby supposed that the cobego is in any sense the missing link between these orders; its leaf-eating habits, as well as the peculiar structure of its incisor teeth, being alone amply sufficient to disprove its claim to that position; — the insect-eating bats, which appear to be the ancestral groups of the order to which they belong, having in all probability been directly derived from insect-eating Insectivores. The cobego should, indeed, be regarded rather as the sole representative of a side-branch, which, while to some extent simulating the bats, never gave rise to any descendants showing the special modifications for true flight.

THE TREE-SHREWS, OR TUPAIAS

Family *TUPAIIDÆ*

With the tree-shrews, or tupaia, we come to the first family of the true Insectivores, or those which are incapable of flight, and have their front or incisor teeth of a normal form.

The tree-shrews, which are entirely confined to the Oriental region, take their name from their strictly arboreal habits; and are small, long-tailed animals, so closely resembling the smaller squirrels in external appearance as to be frequently mistaken for them. Indeed, it appears that the native term Tupai, from which these animals derive their second title, is applied indifferently by the Malays both to them and to squirrels; the affix Tana serving to denote the members of the present group. That they have really nothing to do with the squirrels is shown by an examination of their teeth, when it will be found that, instead of the single pair of chisel-like incisor teeth, they have two pairs of small incisors in the upper jaw, and three pairs in the lower.

Character-istics The tree-shrews belong to a group of Insectivores characterized by their upper molar teeth, having broad crowns carrying a number of cusps, arranged in the form of the letter W. They are peculiar in that the socket of the eye, or orbit, is surrounded by a bony ring, whereas in other members of the order it is open behind. They are further distinguished from the other true Insectivores not only by their completely arboreal, but likewise by their diurnal, habits, as they feed entirely by day. They resemble squirrels in the general form of the body and limbs, and in possessing a more or less bushy tail. They have 38 teeth, of which $\frac{2}{3}$ are incisors, $\frac{1}{3}$ canines, and $\frac{6}{3}$ cheek-teeth, on either side of each jaw. Their feet, like those of squirrels, are naked beneath, with moderately curved and sharp claws. The muzzle is sharply pointed, the ears are small and rounded, and the long hair of the bushy tail is confined to its upper surface and sides, the under surface having much shorter hair.

Distribution Altogether, there are about thirteen species of the genus *Tupaia*, which have a wide distribution over the Oriental region. They are found in India, Burma, the Malay Peninsula, the Nicobar islands, Sumatra, Java, Borneo, and the Philippines. They are very much alike in general appearance, the

species differing mainly in respect of size and color, as well as in the length of the fur. Many are restricted to particular islands ; the Bornean tree-shrew, the Nicobar tree-shrew, and the recently discovered Philippine tree-shrew, being unknown out of the islands from which they take their names. Others, again, have even a still more restricted distribution ; two species having hitherto been obtained only in the forests of Mount Dulit in North Borneo.

The largest member of the group is the Bornean tree-shrew (*Tupaia tana*). They may be found in clumps of trees as well as in forests ; and, in addition to their resemblance to squirrels in appearance, they simulate those animals very closely in their movements, as they may not unfrequently be seen sitting upon their hind-quarters and holding their food in their fore-paws. Their food consists of in-



THE COMMON TREE-SHREW.
(One-third natural size.)

sects and fruit ; and although insects are usually sought on trees, tree-shrews may sometimes be seen hunting for food on the ground.

The Madras tree-shrew (*T. ellioti*), which is found in the forests of the greater part of Peninsular India to the southward of the plains of the Indus and Ganges, is a well-known species, of which the head and body measure from seven to eight inches in length, while the tail (including the hair) is about one inch longer. From the fact of several of this species having been met with by Professor Ball lying dead in the jungle, it would seem that a fate similar to that which overtakes at certain times of the year our common English shrew also befalls the tupaia. The Malay tree-shrew (*T. ferruginea*) is a rather smaller species, with a much wider distribution, extending from Assam and the Eastern Himalayas (where it is found at elevations of from three thousand to six thousand feet) to Burma and the Malayan islands.

Habits

Of the Malayan species, General M'Master writes, that it "is a harmless little animal, in the dry season living in trees, and in the monsoon entering our houses, and in impudent familiarity taking the place held in India by the common palm-squirrel; it is, however, probably from its rat-like head and thievish expression, very unpopular. I cannot," he adds, "endorse Jerdon's statement as to their extraordinary agility, for they did not appear to me to be nearly as active as squirrels; at least I remember one of my terriers on two occasions catching one—a feat which I have never seen any dog do with a squirrel. Cats, of course, often pounce upon them." Another observer, the Rev. Mr. Mason, remarks that "one that made his home in a mango tree, near my house at Tonghoo, made himself nearly as familiar as the cat. Sometimes I had to drive him off the bed, and he was very fond of putting his nose into the teacups immediately after breakfast, and acquired quite a taste both for tea and coffee. He lost his life at last by incontinently walking into a rat trap." The familiarity of this tree-shrew, and the ease with which it can be tamed, are mentioned by all who have written of its habits; and Dr. Cantor mentions that after feeding they are in the habit of dressing their fur and paws, after the manner of a cat, and that they are partial to water both as a bath and to drink. In disposition they are described as being pugnacious in the extreme, fighting fiercely with one another when confined together in a cage, and in their wild state driving away all intruders of their own kind from their particular preserves. Their usual call is a short, peculiar, tremulous, whistling sound, but when roused to anger it is changed to shrill protracted cries.

The resemblance of the tree-shrews to the squirrels comes under the head of what is now termed "mimicry," and may have been originally due to the extreme agility of the latter animals insuring them from pursuit by other creatures, as being a useless task. Hence it would clearly be an advantage for a slower animal to be mistaken for a squirrel. There is, however, a remarkable little squirrel (*Sciurus tupaoides*) found

in Sumatra and Borneo, which appears, for some reason or other, to simulate the tree-shrews, and thus to afford an instance of a kind of reversed mimicry. "Not only does this Rodent," remarks Blyth, "resemble *T. ferruginea* in size, and the



PEN-TAILED TREE-SHREW.
(One-half natural size.)
(From Gray.)

texture and coloring of its fur, but the muzzle is similarly elongated, and there is even the pale shoulder streak usual in the genus *Tupaia*."

Pen-Tailed Tree-Shrew In addition to the ordinary genera, the only other living member of the family is the pen-tailed tree-shrew (*Ptilocercus lowi*), which differs so remarkably in the structure of its tail as to form the solitary representative of a distinct genus. This little animal is between five and six inches in length, exclusive of the tail, which is of great length, and characterized by its upper two-thirds being naked, and the lower third ornamented with a double fringe of long hairs, arranged like the barbs of a feather. The general color of the fur is blackish brown above, with the cheeks and lower parts yellowish, and a dark streak running backwards from the muzzle to encircle the eye; while the tail is black, with most of the long hairs of the "pen" white. The first specimen known was captured by Mr. Low in the house of Sir James Brooke, at Sarawak; and the species was considered to be confined to that island. Of late it has, however, been discovered in some of the small islands in the neighborhood of Borneo.

Fossil Tree-Shrews As is the case with many of the Mammals of the Oriental region, the tree-shrews were represented in Europe during the middle of the Tertiary period by certain extinct genera. One of these (*Lanthanotherium*) appears to have been very nearly related to the living tree-shrews, while the other (*Galerix* or *Parasorex*) presents characteristics that connect it both with the tree-shrews and the jumping shrews.

THE JUMPING SHREWS

Family *MACROSCOLIDIDÆ*

As the tree-shrews simulate the squirrels in the Rodent order, so the jumping shrews approximate in form to the gerboas and gerbils. But while the resemblance in the former instance is a case of true mimicry, in the other it appears to be merely due to adaptation for a similar mode of life.

The jumping shrews, or, as they are sometimes called, in allusion to their prolonged snouts, elephant-shrews, are the African representatives of the tree-shrews, with which they agree in many points of their structure, although not in habits. They are exclusively confined to Africa; and while agreeing with the members of the preceding family in the relatively large size of their brains, as well as in certain other features of their internal anatomy, they are distinguished by structural differences entitling them to be regarded as the representatives of a separate family. Among these differences we may refer to the circumstance that the socket of the eye is not surrounded by a bony ring, but is open behind. Then, again, the metatarsus, or that portion of the foot immediately below the ankle joint, instead of being of the normal proportions, is greatly elongated, so as to make the whole foot nearly as long as the lower leg. Further, instead of pursuing an arboreal and diurnal life, like the tree-shrews, the jumping shrews restrict themselves to the ground, upon which they progress by leaps, and are mainly or entirely nocturnal.

Typical Forms The typical jumping shrews, constituting the genus *Macroscelides*, of which a species (*M. typicus*) is represented in the illustration on this page, are characterized by the number of their teeth and toes. With one exception, these animals have 42 teeth, of which $\frac{3}{8}$ are incisors $\frac{1}{4}$ canines, and $\frac{9}{8}$ cheek-teeth on either side of the jaws. Invariably they possess five toes on the fore feet; while, with the single exception above mentioned, where there are but four, the same number obtains in the hind foot. Their ears are large, and the tail naked and rat like.

Distribution Numerous species of this genus are found over a large part of the African continent, their range extending from the Cape to Algiers; and most of them being very much alike, both as regards size, form, and color. The species figured here is the Cape-jumping shrew, a tawny-brown animal of about



CAPE-JUMPING SHREW.
(One-half natural size.)

five inches in length, exclusive of the tail; the length of the latter being about three inches. They are very common in South Africa, where they dwell among grass and bushes, coming forth at dusk from their hiding places to scour the plains in search of their insect food. The Algerian jumping shrew (*M. rozeti*) is a very similar animal, known to the French colonists of the districts it inhabits as the *rat à trompe*, which is said to vary the insect diet of the Cape species with an admixture of vegetable food. Like the tree-shrews, this species can be readily tamed, and soon becomes familiar, not to say impudent.

Rock-Jumping Shrew Of larger size than any of the other species of the genus, is the rock-jumping shrew (*M. tetradactylus*), of the Mozambique coast of East Africa, which derives its name from dwelling in rocky districts, where it conceals itself in the crannies and clefts of rocks. The most important character-

istic of this species is, however, the presence of only four toes to the hind feet, the small inner toes found in the other species having disappeared. It is likewise peculiar in having but forty teeth, owing to the loss of the last molar on either side of the lower jaw.

More remarkable than any of the above are the long-nosed jumping shrews, of which there are four species from Zanzibar and the adjacent regions of the East Coast of Africa. These collectively constitute the genus *Rhynchocyon*, distinguished from the preceding group by having only thirty-six teeth, and but four toes on both fore and hind feet. Further, the hind limbs are relatively shorter than in the typical jumping shrews, while the muzzle is so much produced as to form a veritable trunk. The reduction in the num-

ber of the teeth is due to the disappearance of two out of the three pairs of incisors in the upper jaw; and in very aged individuals even the single remaining pair may be shed, thus leaving the creature without any upper front teeth. The length of the head and body of the best-known species is about eight inches; and that of its long, scaly, rat-like tail somewhat less. Its general color is rusty brown, becoming blacker on the top of the head and along the back; while the flanks have some bright reddish spots just below the hinder part of the back.

Habits

From the reduction in the number of their teeth and toes, as well as from the prolongation of the muzzle, we may regard the long-nosed jumping shrews as very spe-



ROCK-JUMPING SHREW.
(One-half natural size.)
(From a Plate by Peters.)

cialized creatures. Unfortunately, we know little or nothing of their habits; but from their relatively shorter hind legs it may be assumed that they are less habitual leapers than the typical members of the family. Like many of the more aberrant Insectivores, the long-nosed jumping shrews appear to be very rare animals.

THE HEDGEHOGS AND GYMNURAS

Family *ERINACEIDÆ*

The hedgehogs and their near allies the gymnuras constitute a well-marked family, distinguished by several important characteristics from the preceding groups.

The more important of these characteristics are, however, of such a nature as to be but briefly referred to in this place. It may be observed, however, that the brain (as may be readily seen from the dimensions of its chamber in the dried skull) is relatively smaller, and the union of the anterior elements of the pelvis in the middle line on the inferior aspect of the body shorter, than in the preceding families. Further, if the cavity for the eye in the dried skull be examined, it will be found that there is not even a trace of any bony process to mark off its hinder limit from the larger hollow containing the muscles that work the lower jaw. With the exception of one species, all the members of the family have five-toed feet, provided with simple claws not adapted for digging; this feature being in accordance with their purely terrestrial and non-fossorial habits. And the broad first and second molar teeth of the upper jaw are characterized by having five distinct cusps, of which the central one is very small, and connected with the two inner ones by a pair of oblique ridges.

THE HEDGEHOGS

Genus *Erinaceus*

The European hedgehog, or urchin, which is far the largest of the British Insectivores, is the best known representative of a somewhat extensive genus distributed over the greater portion of Europe, and parts of Africa and Asia, although unknown in Madagascar, the Malayan Peninsula and islands, Burma, Southern China, and Siam.

The essential characteristics of the hedgehogs, as distinct from the gymnuras, are to be found in the dense coat of short spines covering the back and sides of the body, and also the shortness of the tail. The hedgehogs have 36 teeth, of which, on each side, $\frac{2}{3}$ are incisors, $\frac{1}{4}$ canines, and $\frac{5}{6}$ cheek-teeth. An examination of the skull will show that the first pair of front or incisor teeth in the upper jaw have remarkably long crowns, which are widely separated from one another in the middle line; while the two remaining incisor teeth on each side of the same jaw are much smaller. It will further be observed that the middle region of the palate of the skull contains some open spaces not occupied by bone. The common hedgehog (*Erinaceus europæus*) is characterized by the short and almost imperceptible neck, the pig-like snout, from which it derives its popular name, and also by the shortness of its limbs. Exclusive of the short naked tail, which measures about one and one-half inches, an average-sized hedgehog is about ten inches in length. The great peculiarity of all the hedgehogs is the power they possess of rolling themselves up into a ball-like form, presenting a *chevaux-de-frise* of spikes, impenetrable to the great majority of other animals. This rolling-up process is effected by the aid of an extraordinary development of a layer of muscles found beneath the skin of most Mammals, and known as the *panculus carnosus*. When rolled up, the head and feet are tucked inwards, so that only the spines are exposed; and it requires a bold dog or fox to attack a hedgehog when in this condition. Under the microscope the spine is seen to be marked by a number of parallel longitudinal grooves; the ridges

between them being ornamented, in some of the foreign species, with rows of tubercles. Hedgehogs date from a remote antiquity ; and it is doubtless solely due to this protective armor of spines that animals of such low organization and of such comparatively large size have been enabled to survive without resorting to the protection afforded by a subterranean or aquatic mode of life.

Habits The food of the European hedgehog is very varied, including insects, worms, slugs, snails, lizards, snakes, birds' eggs, rats, mice, and other small animals ; while roots and fruit are also consumed to a certain extent. The partiality of hedgehogs for insects is often taken advantage of in ridding houses of beetles and cockroaches ; although the hedgehog itself not unfre-



THE COMMON HEDGEHOG.
(One-third natural size.)

quently comes to an untimely end by a too close approach to the kitchen stove for the sake of warmth. A hedgehog kills a snake by inflicting a series of bites, and quickly assuming the defensive when threatened with attack. That eggs are largely consumed by these animals is proved by the readiness with which they are caught in traps thus baited. On account of such depredations, as well as from their destructiveness to young birds, they are much persecuted by gamekeepers. There is, moreover, at least one instance on record of a hedgehog, having attacked a

young leveret, which it would doubtless have dispatched had it not been interrupted. Hedgehogs venture forth from their hiding places in hedges, coppices, or shrubberies during summer, as soon as the dews of evening commence, and may be detected devouring worms or other prey on moonlight nights. A worm is eaten slowly by being seized by one extremity, and turned from side to side of the mouth, while it is being chewed by the sharp cheek-teeth ; much the same process taking place in the case of a snake.

Although properly nocturnal in their habits, they may occasionally be met with searching for food during the day ; and it has been suggested that on such occasions they are driven to depart from their ordinary habits by the necessity of procuring a sufficient supply of food for their young, which are usually produced



HEDGEHOG AND YOUNG.

during the months of July and August, and are said not to exceed four in a litter, although it was formerly considered that the number might be as many as eight. Occasionally a second litter is produced during the autumn ; and it is believed that the period of gestation is not longer than a month. The new-born young are almost naked, and their imperfect spines are soft, flexible, and white, although rapidly hardening in the course of a few days. They are at first totally blind, and quite incapable of rolling themselves up. The nest in which the young are born is carefully constructed, and is said to be always protected from rain by an efficient roof. In winter the European hedgehog hibernates completely, laying up no store of food, but retiring to a nest of moss and leaves, where, rolled up in a ball, it lies torpid till awakened by the returning warmth of spring. As a rule hedge-

hogs are comparatively silent creatures, but on occasions they give vent to a sound said to be something between a grunt and a low piping squeak.

Distribution The range of the hedgehog in Britain includes the whole of England and portions of Ireland, but does not extend beyond the middle of Scotland; its presence in the Shetland islands being probably due to human introduction. Eastward it extends to Eastern China and Amurland, and it also embraces the region from the sixty-third parallel of latitude in the Scandinavian Peninsula, to Southern Italy, Asia Minor, and Syria. Not only is the European hedgehog found in the lowlands of the regions over which it extends, but in the Alps it ascends to an elevation of six thousand feet, and in the Caucasus to upwards of eight thousand feet above the sea level.

Altogether there are nearly twenty known species of hedgehogs, and among these the European form is in some respects quite peculiar. Its fur mingled with the spines is very coarse and harsh, and the upper tusk, or canine tooth (the fourth tooth from the extremity of the muzzle), is inserted by a single root, while in all the others the fur is softer and finer, and the upper canine tooth has two roots, and closely resembles the cheek-teeth.

Hedgehogs are represented by five distinct species in India, all characterized by having minute tubercles on the ridges of their spines. It is remarkable that while one of these hedgehogs (*E. micropus*) is found in Madras, no representative of the genus is recorded from the Central Provinces and Bengal, the other species not occurring till we reach the Northwest Provinces, the Punjab, etc. But little is known of the habits of these Indian species, and nothing as to their breeding; although it is probable that in both these respects they conform closely to their European cousin. The long-eared Afghan hedgehog (*E. megalotis*), common in the neighborhood of Kandahar and Quetta, hibernates, but the species from the Punjab and Southern India are active at all seasons of the year, thus showing how absolutely dependent is the habit of hibernation upon climate. The collared hedgehog (*E. collaris*), found in the plains of Northwestern India, inhabits "sandy country, hiding in holes beneath thorny bushes or in tufts of grass during the day, feeding chiefly on insects, especially a species of *Blaps*, and also on lizards and snails. It makes a grunting noise when irritated, and when touched suddenly jerks up its back so as to throw its spines forward, making at the same time a sound like a puff from a pair of bellows." Mr. Blanford just quoted, also states that the Afghan hedgehog feeds on the slugs and snails so common in the fields round Kandahar, as well as worms, insects, and lizards. It hides during the day in holes; and hibernates from the end of October or beginning of November till February.

African Species If we know but little of the habits of the Asiatic hedgehogs, this lack of information is still more marked with respect to those of Africa, where some species are found in the Cape district, and others in the regions to the north of the Sahara (*E. algirus*), and in Egypt, as well as on the West Coast. One of these (*E. albiventris*) is peculiar in having lost the inner toe of the hind foot; although its claw has been found on one foot of an adult female from Lagos, as well as on both feet of young specimens from the same locality.

Extinct Species Fossil hedgehogs were met with in the Tertiary rocks of Europe as far back as the early portion of the Miocene period. Some of the extinct hedgehogs belonged to the existing genus *Erinaceus*; and one of them (*E. æningensis*), from the middle Tertiary fresh-water limestones of Baden, appears to be allied to the Algerian hedgehog, being totally different in the structure of its teeth from the common European species. Others are, however, distinguished by having a complete bony roof to the palate, and these form a distinct genus, which may be allied in this respect to the gymnuras.

THE GYMNURAS

Genus *Gymnura*

The gymnuras, which are not unlike large rough-haired shrews, take the place of the hedgehogs in Burma and the Malayan region. Although closely allied to the hedgehogs in the structure of their teeth and other details of their anatomy, these Insectivores are so unlike them in external appearance that it is difficult to believe in their close affinity. It must be remembered, however, that the spines of the hedgehogs totally alter the appearance of the creature from what it would be if unprovided with these appendages; and if we were to compare a gymnura with a young hedgehog, in which the spines were still rudimentary, the difference in appearance would not be so very marked.

Characteristics The gymnuras are distinguished from the hedgehogs by the total absence of spines; and also by the long naked tail, from which they derive their name. Further points of distinction are afforded by the complete bony roof to the palate, and also by the larger number of teeth in the gymnuras, which is upwards of forty-four.

The large and typical number of teeth characteristic of these animals is, indeed, but very rarely met with among existing Mammals, although it was common amongst extinct forms. In this respect, therefore, the gymnura betrays the antiquity of the group to which it belongs.

Raffles's gymnura (*Gymnura rafflesi*) — so named after Sir Stamford Raffles — is an animal somewhat resembling a large rat with a long pointed nose; the length of the head and body varying from twelve to fourteen inches, and that of the long rat-like tail from eight and one-half to nine and one-half inches. The head and body are generally parti-colored, with considerable individual variation in the distribution of the black and white. Usually, however, the greater part of the head and neck is white; but there is a black patch in front



RAFFLES'S GYMNURA.

of and another above each of the eyes, and there are frequently some long black hairs on the crown of the head. The terminal third of the tail is generally white. Occasionally specimens are found in Burma of a uniform white color throughout; these, however, must not be regarded as albinos. The hair is of two kinds—a close, soft under-fur and long coarse bristles.

Distribution Raffles's gymnura is found in the islands of Sumatra and Borneo, in the Malay Peninsula, and in Burma. It is either a rare animal, or on account of its retiring and strictly nocturnal mode of life is but seldom met with. Of its habits we are still ignorant. It is, however, said to make its home beneath the roots of trees; and, from the contents of the stomachs of specimens that have been examined, we learn that its food consists of different kinds of insects; cockroaches, white ants, and larvæ being apparently its favorites. It is distinguished by a peculiarly disagreeable smell of a somewhat oniony or garlic-like nature.

Still more rare is the lesser gymnura (*G. suilla*), a small rusty-brown colored animal, paler beneath, measuring just short of five inches in length, with a tail not exceeding one inch. It occurs in Burma, the Malay Peninsula, Sumatra, Borneo, and Java, ascending in Borneo to a considerable elevation above the sea level on Mount Kina Balu in the northern part of the island.

Extinct Gymnuras Extinct Insectivores, more or less closely allied to the gymnuras, have left their remains in the Tertiary deposits of France belonging to the upper portion of the Eocene and the lower part of the Miocene period. These extinct forms, although belonging to distinct genera from those now existing, serve to show the antiquity of this group of animals; and, in common with many others, further indicate how the early Tertiary fauna of Europe has its nearest representatives in the remote islands of the Malayan Archipelago.

THE SHREWS

Family *SORICIDÆ*

The elegant little creatures known as shrews, or shrew-mice, as they are often termed from their mouse-like form, constitute the fourth family of the true Insectivores. So like, indeed, are these animals to mice and rats, that in popular estimation they are often confounded with them; although they are readily distinguishable by their long and pointed snouts, their rounded ears, closely pressed to the sides of the head, and the characteristics of their teeth.

Though there would be little likelihood of mistaking a shrew for a hedgehog, it is necessary to point out in some detail the characteristics on which naturalists refer these groups to separate families; since as we have seen, the spines of the hedgehogs do not form a characteristic of more than generic importance.

Perhaps the most ready means of determining whether or no an Insectivore belongs to the shrew family is afforded by the characteristics of the first pair of front or incisor teeth. In all shrews these teeth are different from the others; those of

the upper jaw (as shown in the figure) being long and generally sickle shaped, with a more or less distinct cusp at the base of their hinder border; while in the lower jaw they are long and project horizontally forwards, sometimes curving upwards at the tips. Moreover, with the single exception of one peculiar African species, which has a rudimental seventh tooth, the lower jaw of every shrew has only six teeth on each side.

The above features are sufficient to distinguish a shrew from any other Insectivore; but a few additional characteristics may also be mentioned. Thus the first and second upper molar teeth of all the shrews differ from those of the hedgehogs and gymnuras by the absence of the fifth or central cusp on the crown. Then, again, the skull of a hedgehog or gymnura, as shown in the figure of the skeleton of the former given on p. 311, has a complete bony bar—the zygomatic arch—running below the socket for the eye to connect the upper jaw with the hinder part of the skull. In a shrew, on the other hand, this bony arch, as shown in the figure on the next page, is invariably incomplete beneath the eye, owing to the absence of the cheek bone.* A further characteristic feature of the shrews is the extreme length and narrowness of their skulls.

With the exception of a few species which have taken to an aquatic life, the shrews are terrestrial and nocturnal in their habits. They are all covered with fur, generally remarkable for its softness; the head is long, with a sharply-pointed snout projecting far in advance of the tip of the lower jaw; their eyes are extremely small and bead like; and the external ears, if present at all, are rounded, and not unlike the human ear in general contour.

The shrews have a more extensive distribution than any other family of Insectivores, and likewise comprise a far larger number of species. They are to be met with throughout the whole of the temperate and tropical regions of Europe, Asia, Africa, and North America, as well as on many of the adjacent islands; one species extending as far north as Unalaska island in the Aleutian group. "From their obscure and retiring habits," writes Bell, "the shrews are difficult of observation; their long and pointed snout, their extensible form, and short and velvety coat enable them to pass through the closest herbage, or beneath the carpets of dry leaves in the coppice and woodland, in which situations, as well as in the open fields, whether cultivated or in pasture, they seek their food. But they are not confined in their habitat to such situations, as with their congeners, the water-shrews, they are often met with in marshy and fen districts." On the other hand, one of the Indian shrews constantly frequents dwelling houses. The number of genera (to say nothing of species) of shrews is so considerable, that it is only possible to notice here some of the more interesting and



SIDE VIEW OF THE RIGHT ANTERIOR UPPER TEETH OF THE SWIMMING-SHREW FROM UNALASKA ISLAND.

(Much enlarged. The first upper incisor—the tooth on the right of the figure—is less sickle shaped than usual.)

(After Dobson.)

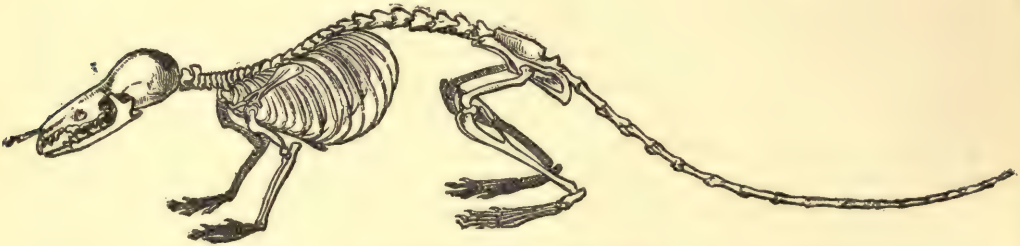
*In one Indian hedgehog the zygomatic arch is incomplete.

important. The genera may be arranged under two groups, according as to whether the teeth are stained of a reddish-brown color or are of the ordinary white hue.

THE TYPICAL SHREWS

Genus *Sorex*

In addition to their red teeth, the typical shrews, as represented by the common European shrew (*Sorex vulgaris*), figured on the right side of the illustration on p. 329, are characterized by the number of their teeth being thirty-two, and by the large size of their ears and the length of the tail; the latter being covered with hairs of nearly, or quite, uniform length. With the exception of two peculiar species, all these shrews are terrestrial; and they inhabit Europe, Asia north of the Himalayas, and North America. And it may be remarked here that the red-toothed shrews are quite unknown in Africa south of the Sahara, and they are only represented in India and the rest of the Oriental region by a single small genus (*Soriculus*).



SKELETON OF WATER-SHREW.

Common Shrew

The common shrew, found abundantly in the British Islands, measures just short of three inches in length, exclusive of the tail, and is usually of a reddish mouse color above, paler beneath, with the tail somewhat quadrangular and rather shorter than the body. There is, however, considerable individual variation in color, specimens being sometimes found banded with white.

Habits

Like the mole, the common shrew has a wide geographical range, extending from England, through Europe and Asia to North America. The facility with which this species conceals itself has been already mentioned. Its food is chiefly insects and worms, supplemented by snails and slugs. In disposition it is so pugnacious that two are rarely seen together except when engaged in combat; and if two or more are confined together, it is not long before the stronger kills the less robust. The strong scent with which the shrew is provided probably acts as a preventive against the attacks of some of its foes, but it is now ascertained that this is not sufficiently repulsive to deter owls from killing and devouring shrews. It was long considered that the numbers of dead shrews to be found in most gardens during the autumn were due to the attacks of cats, which are known

to kill, although they will not eat these animals. Dr. Dobson considers, however, that the real cause of death is rather to be attributed to insufficiency of their proper food at that season of the year; and this interpretation is supported by the consideration that it would be otherwise difficult to account for the mortality being confined to one period of the year. Shrews hibernate in Europe throughout the winter, and during the spring and summer produce their litters of blind and toothless young; the number in each litter being usually five, six, or seven, but occasionally more.

Lesser Shrew In Ireland the place of the common shrew is taken by the lesser shrew (*S. pygmaeus*), which although also found in England, is there much more rare. It may be distinguished by its inferior size, and also by the circumstance that the third tooth from the extremity of the upper jaw (the third incisor) is not longer than the fourth. Like its larger cousin, this species has an



THE SPIDER MUSK-SHREW AND COMMON SHREW
(Natural size.)

extensive range in Europe and Asia north of the Himalayas, but does not extend across Behring Strait into America.

Alpine Shrew In marked contrast to the wide range of these species is the restricted distribution of the Alpine shrew (*S. Alpinus*), a species of rather larger size than the common shrew, and distinguished by the uniform coloration of the upper and under surfaces of the body. This shrew is only found in the mountains of Central Europe.

North American Shrews A variation in size comparable to that existing among the European members of the genus is likewise found in its North American representatives, among which Bendire's shrew (*S. bendirei*) is the largest, and Cooper's shrew (*S. cooperi*) the smallest form. Of the latter Dr. Hart Merriam

writes that "although underground life does not appear to be as attractive to it as to its relatives the moles, yet it avoids too much exposure, and commonly moves, by night and by day, under cover of the fallen leaves, twigs, and other débris that always cover the ground in our northern forests. The naturalist well knows that, however cautiously he may walk, the stir of his footsteps puts to flight many forms of life that will reappear as soon as quiet is restored; therefore in his excursions through the woods, he waits and watches, frequently stopping to listen and observe. While thus occupied, it sometimes happens that a slight rustling reaches his ear. There is no wind, but the eye rests upon a fallen leaf that seems to move. Presently another stirs, and perhaps a third turns completely over. Then something evanescent, like the shadow of an embryonic mouse, appears and vanishes before the eye can catch its perfect image. Anon the restless phantom flits across an open space, leaving no trace behind. But a charge of fine shot dropped with quick aim upon the next leaf that moves will usually solve the mystery. The author of the perplexing commotion is found to be a curious sharp-nosed creature, no bigger than one's little finger, and weighing hardly more than half a dram. Its ceaseless activity, and the rapidity with which it darts from place to place, are truly astonishing, and rarely permit the observer a correct impression of its form. Whenever a tree or a large limb falls to the ground these shrews soon find it, examining every part with great care, and if a knot hole or crevice is detected leading to a cavity within, they are pretty sure to enter, carry in materials for a nest, and take formal possession. . . . Not only are these agile and restless little shrews voracious and almost insatiable, consuming incredible quantities of raw meat and insects with great eagerness, but they are veritable cannibals withal, and will even slay and devour their own kind."

The marsh-shrew (*S. palustris*) from the Rocky mountains, together with the swimming shrew (*S. hydrodromus*) from one of the Aleutian islands, differ from the other members of the genus in having their feet provided with fringes of long hair to aid them in their aquatic life.

THE SHORT-TAILED OR EARLESS SHREWS

Genus *Blarina*

With the exception of the water-shrews, the only other members of the red-toothed section of the family to which we shall allude are the so-called short-tailed and earless shrews, of North and Central America. These shrews are readily distinguished by their short tails and the truncation of the upper part of their ears; some of them having the same number of teeth as the typical shrews, while in others the number is reduced to thirty. The variation in the size of the different species of this genus is nearly as marked as in the preceding one.

The common short-tailed shrew (*Blarina brevicauda*) occurs in the Adirondack mountains, near New York, and is remarkable for remaining active during the whole of the rigorous winters of these regions, having been observed running about



WEB-FOOTED SHREWS.

on the snow when the thermometer indicated 20° below zero. This peculiar habit is correlated with equally marked peculiarities in the diet of this species, which frequents both the dense pine forests of the uncultivated districts, and the cleared tracts of the inhabited regions. This shrew, writes Dr. Merriam, "seeks its food both by day and night; and, although the greater part of its life is doubtless spent under ground, or at least under logs and leaves, and amongst the roots of trees and stumps, it occasionally makes excursions upon the surface, and I have met and secured many specimens in broad daylight. It subsists upon beechnuts, insects, earthworms, slugs, sow bugs, and mice, and can in no way be considered other than as a friend to the farmer."



THE WATER-SHREW.
(Natural size.)

THE WATER-SHREW

Genus *Crossopus*

The water-shrew (*Crossopus fodiens*) is the sole representative of a genus agreeing with some of the short-tailed shrews in possessing thirty teeth, but distinguished by the small ears not being truncated, by the long tail, and also by the fringes of long hair on the under surface of the latter and on the feet. This shrew, as its name implies, is of thoroughly aquatic habits; the fringes of stiff hair on the tail and limbs being designed to afford aid in swimming. In length it measures about three and one-fourth inches, exclusive of the long tail. Owing to the circumstances, that while in most cases the under parts of the body are white, while in others they partake more or less completely of the black hue of the back, it was

formerly considered that there were two distinct species of water-shrews, although subsequent observations have shown that such variations are merely individual.

Habits

The water-shrew, although unknown in Ireland, is commonly, but locally, distributed over England and the south of Scotland. It likewise occurs over a large area of continental Europe, from whence it extends eastward into Asia as far as the Atlas range. In the water these graceful little creatures are as much at home as water-voles or beavers; and in clear streams they may not unfrequently be observed during the day diving or running along the bottom, and turning over the pebbles with their sharp noses in search of fresh-water shrimps, which appear to constitute their favorite food. In addition to these crustaceans, the water-shrew devours many kinds of aquatic insects or their larvæ, while it is also probable that it likewise preys on the spawn or fry of minnows and other small fish. There are, moreover, several instances on record where water-shrews have been found feeding on the flesh of larger animals, which they have found dead. The swimming of the water-shrew, writes Professor T. Bell, seems to be "principally effected by the alternate action of the hinder feet, which produces an unequal or wriggling motion; it makes its way, however, with great velocity, and as it swims rather superficially, with the belly flattened, the sides, as it were, spread out, and the tail extended backwards as a rudder, it forms a very beautiful and pleasing object, moving on the calm surface of a quiet brook, or diving, in an instant, after its food, its black velvety coat becoming beautifully silvered with the innumerable bubbles of air that cover it when submerged; and on rising again the fur is observed to be perfectly dry, repelling the water as completely as the feathers of a water-fowl. When submerged, the ear is nearly closed by means of three little valves." The burrows of the water-shrew are constructed in the banks of the pond or stream in which it dwells; and, if disturbed from the protection thus afforded, the creature plunges forthwith into the water to seek safety in what must be regarded as its native element. The female gives birth to the young in the burrow, the usual number produced at a litter varying from five to seven or eight.

In addition to its darker coloration, and the structural differences already mentioned, the water-shrew may be distinguished at a glance from the common shrew by its stouter and somewhat depressed muzzle. The red stain on the teeth is, moreover, much less decided than in the latter; and indeed, when the teeth have been much worn by long use, tends more or less completely to disappear.

THE MUSK-SHREWS

Genus *Crocidura*

With the musk-shrews, which include by far the largest representatives of the entire family, we come to the first members of the group characterized by their white teeth. No representatives of the musk-shrews occur in Britain, although the spider musk-shrew (*Crocidura aranea*), represented on the left side of the illustration on p. 329, and the common musk-shrew (*C. suaveolens*), shown in the accompany-

ing figure, occur on the continent of Europe. These shrews, which are of terrestrial habits, have either twenty-eight or thirty teeth, well-developed ears, and a long tail, and are covered with a coat of mingled long and short hairs. The eyes are very small, and placed nearer to the ears than to the tip of the nose. Each side of the body is furnished with a gland (sometimes absent in the female) secreting the musky product from which these shrews derive their popular name.

More than eighty species of musk-shrews have been described; the range of the genus embracing Southern and Central Europe, Africa, and Asia. The species with the widest range is the spider musk-shrew, above mentioned, which is found from North Africa and Central and Southern Europe to Central Asia, extending as far north as Northeastern Siberia, and as far south as Ladak. It belongs to the typical group of the genus, characterized by having only three small conical teeth



THE COMMON MUSK-SHREW.
(Natural size.)

behind the large first upper incisor; and it is a comparatively small species, of about three inches in length, exclusive of the tail. This shrew frequents cultivated grounds in Europe, not unfrequently entering houses; and preys on insects, worms, and the young of the smaller Mammals and birds. The young are born in summer, and vary from five to as many as ten in number.

The common musk-shrew (*C. suaveolens*), of which a figure is given above, is the second representative of the genus *Crocidura* in Europe. It belongs to a group characterized by the presence of four small conical teeth, of which the hindmost is very minute, behind the first upper incisor tooth.* This group, which is

*In the figure of the jaw of a true shrew (*Sorex*) on p. 327 there are five of these small teeth

numerously represented in India, includes the largest of all shrews, and those most strongly scented with the characteristic musky odor. The best known, and at the same time the largest, of these Indian species are the brown musk-shrew (*C. murina*), and the gray musk-shrew (*C. caerulea*), the latter of which is commonly termed by Anglo-Indians the musk-rat. Both these species have nine teeth on each side of the upper jaw, and their length may be as much as six inches exclusive of the tail. Whereas the hair of the former is of a brownish tinge on the body and feet, in the latter it is more of a slaty hue; while the feet are flesh colored or yellowish white. In other respects these two shrews are very closely allied, but whereas the brown musk-shrew is found as a rule in woods (although it will occasionally enter buildings), the gray musk-shrew generally, if not invariably, haunts human habitations. It has accordingly been suggested that the latter is merely a peculiar variety of the former. The gray musk-shrew is nocturnal, and is a common visitor to Indian houses. During the day it lies concealed in holes and drains, issuing forth at night to hunt over the floors of rooms for cockroaches and other insects; while thus engaged it utters from time to time a short, sharp squeak. In respect to its insect-eating habits, this musk-shrew is a benefactor to mankind; but these benefits are accompanied by the drawback that various articles may be so impregnated with the musky secretion of the animal as to become utterly useless. There has, however, been much exaggeration as to the penetrating power of this scent, the well-known but absurd story that wine or beer becomes impregnated with a musky flavor from the circumstance of one of these shrews having run over the outside of the bottle containing such liquor, being a case in point. In addition to its favorite cockroaches and other insects, the gray musk-shrew will also readily devour meat, and accounts are on record of an attack made by one of these animals on a frog and by another on a snake.

Other Indian musk-shrews belonging to the same group of the genus, such as Blyth's musk-shrew (*C. fuliginosa*) have but eight teeth on each side of the upper jaw, or the same number as in the European spider musk-shrew (*C. aranea*).

THE BURROWING SHREWS

Genus *Anurosorex*

The burrowing shrews are small mole-like creatures, inhabiting Tibet, Western China and Assam, where they are apparently very rare. They are characterized by their large heads, minute eyes, the absence of ear-conchs, a very short tail, and thick velvety fur. The total number of teeth is twenty-six, of which there are seven on each side of the upper jaw. There are only two species, of which the one from Assam measures about three inches in length, exclusive of the stumpy tail, and is of dark slaty color, with a tinge of brown.

The interest attached to these shrews arises from the circumstance that their structure is indicative of burrowing habits like the mole, although nothing is known on this point from actual observation.

THE SWIMMING-SHREWS

Genus *Chimarrogale*

Although the name swimming-shrews would be equally applicable to the water-shrews (*Crossopus*), and the latter name to the members of the present genus, yet it is convenient to take the two terms with the signification here given. The swimming-shrews, of which one species (*Chimarrogale himalayica*) is found in the Himalayas and Mount Kina Balu in Borneo, and the other (*C. platycephalus*) in Japan, closely resemble the water-shrews in general appearance, but are distinguished by the teeth being entirely white, and likewise by being twenty-eight, instead of thirty in number. These shrews have a small external ear-conch; broad scaly feet, with a fringe of coarse white hairs on their margins, and on the sides of each toe; and the long tail is also fringed with similar hairs. The individual toes are, however, not connected by webs.

The Himalayan swimming-shrew has a slaty-gray fur above, with the tips of the hairs blackish brown. A female measured a little over four and one-half inches in length, exclusive of the tail, the length of the latter being three inches; but it is probable that other individuals are considerably larger. This shrew inhabits the southwestern portions of the Himalayan range, at elevations from three thousand to five thousand feet above the sea level; and it is also found in the hills of North Burma. It inhabits the banks of streams, and, doubtless, swims quite as well as the European water-shrew. Dr. Anderson has observed it plunging into the water, and running over the stones on the bed of a stream. Like its European cousin, it is said to feed on aquatic insects and their larvæ, as well as on tadpoles, and the smaller fish and their fry. The assumption of aquatic habits by members of both the red-toothed and white-toothed sections of the shrews is an interesting example of how animals belonging to different groups may acquire almost exactly similar external characteristics, as being essential to their particular mode of life.

THE WEB-FOOTED SHREW

Genus *Nectogale*

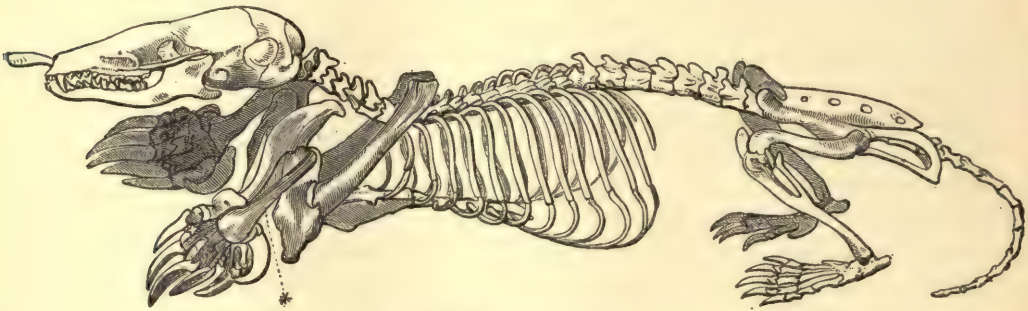
A still further modification for the purposes of an aquatic life is exhibited by the web-footed water-shrew (*Nectogale elegans*) of Tibet, of which a group is shown in our colored plate. In these shrews not only are the feet and tail fringed with hairs, but the external conchs of the ears are wanting, and the toes are completely joined by webs, while the soles of the feet are furnished with large disc-like pads. The web-footed shrew has a tail of four inches in length, while the length of the head and body is but just over three and one-half inches. The fur, which is extremely dense and soft and evidently adapted to withstand the icy cold of the Tibetan rivers, is of a rich dark brown color above with the longer hairs of a glistening white, while the chin and throat are whitish, and the belly light brown.

It does not appear that this shrew has been seen by Europeans disporting in the waters of its native streams. From its structure we may, however, confidently infer that it is more thoroughly aquatic than any other member of the family; and it has been suggested by Milne-Edwards, its original describer, that the disc-like pads on the soles of the feet act as suckers, and thus enable the animal to cling to the surfaces of smooth pebbles or rocks during its sojourn beneath the water.

THE DESMANS AND MOLES

Family *TALPIDÆ*

The European desmans and the more widely-spread moles are the best-known representatives of two sections of a family which, while allied in many respects to the shrews, possess characteristics of sufficient importance to justify its separation therefrom. In the first place, the skull in all the members of the family *Talpidae* is distinguished from that of the *Soricidae* by having a distinct zygomatic arch con-



SKELETON OF MOLE.

necting the upper jaw with the region of the ear; this difference being distinctly shown by a comparison of the figure of the skeleton of the mole given herewith with that of the skeleton of the water-shrew on p. 328. Then, again on the under surface of the hinder part of the skull, whereas the so-called bulla of the internal ear is represented in the shrews merely by an open ring, in the desmans and moles it has a complete bladder-like form. Further, the first incisor tooth of both jaws in the members of the present family is of a normal type, and never assumes the peculiar form which has been shown to be characteristic of all the shrews.

Most of the members of the present family are of fossorial habits, although a few are more or less completely aquatic, and others cursorial. All have long shrew-like skulls, and small eyes and ears; while in most cases the fore limbs are placed very far forward on the body, and are more or less specially modified for the purpose of digging in the ground. The family, although by no means so numerous in species as the shrews, is a comparatively large one, containing at least eight distinct generic modifications. It is entirely confined to the Northern Hemisphere, where it is widely distributed over the temperate regions of Europe, Asia, and North America.

THE DESMANS

Genus *Myogale*

The strange-looking desmans, of which there are two species, are aquatic animals belonging to a section of the family characterized by the fore-limb not being specially modified for the purpose of digging, and thus forming a connecting link between the shrews and the moles. This absence of special modification is exhibited by the bones of the skeleton of the fore-limb, in which the collar bone (clavicle), and the arm bone (humerus) still retain a distinctly elongate form, while there is no additional bone in the fore-foot.



RUSSIAN DESMANS.
(One-half natural size.)

The desmans are provided with the typical number of forty-four teeth, and are further characterized by their completely webbed feet, their long trunk-like snout, which projects far in advance of the upper lip, and the elongated and scaly tail. The Russian desman (*Myogale moschata*) is considerably the larger of the two, its total length being about sixteen inches, of which some six and one-half are occupied by the tail. The fur is dense and thick, like that

of an otter, with the outer portion formed of long stiff hairs, and the under coat soft and woolly. Above, it is of a full reddish brown, and beneath of an ashy gray, with a silvery lustre when viewed in certain lights. The first incisor tooth in each jaw is very large and powerful, the upper one being somewhat chisel shaped. The tail is laterally flattened. This species inhabits the banks of streams and lakes over a large portion of Southeastern Russia, dwelling in

holes after the manner of the water-vole, and being as much at home in the water as an otter. Indeed, the greater part of the creature's time appears to be spent in that element; the burrow, which terminates in a large chamber above the level of the water, being chiefly used as a resting and breeding place. Its chief food consists of aquatic insects and their larvæ, although it probably also devours small fish. Insects and larvæ are sought after by means of the proboscis-like snout, which is used to probe under stones and in chinks and hollows. A sharp hissing sound is given forth when the animal is irritated or disturbed. The specific name of the desman is derived from the musky odor produced by the secretion of a large gland situated beneath the rest of the tail; this taint rendering its flesh quite uneatable. Owing to its beautiful fur, which is not unlike that of the otter or beaver, the Russian desman is largely hunted by the peasants of the regions where it is found; early autumn being the season when the fur is in the finest condition.

Although now confined to the steppes of Southeastern Russia, it is remarkable that the Russian desman once extended as far westward as the British Isles, its fossilized remains having been obtained from the so-called forest bed of the Norfolk coast, which was deposited during the epoch immediately preceding the Glacial period. Remains of extinct species of the genus have also been obtained from the Tertiary deposits of the continent as far back as the lower portion of the Miocene period.

Far smaller than the Russian species is the Pyrenean desman (*M. pyrenaica*), found on both the French and Spanish flanks of the mountain range from which it derives its name. In total length this animal does not much exceed ten inches, of which about one-half is formed by the tail. It is, however, also distinguished from its larger relative by the greater proportionate length of its proboscis, and likewise by the tail being perfectly cylindrical. In mode of life the two species seem to be very similar, although it has been stated that the smaller one has a more marked preference for a diet of fish.

THE MOLE-SHREWS

Genera *Urotrichus* and *Uropsilus*

A very brief notice must suffice for the curious mole-shrews, which closely connect the moles with the shrews. The true mole-shrews, of which there are two species, constitute the genus *Urotrichus*, and are respectively found in Japan and North America. They have 36 teeth, of which $\frac{2}{3}$ are incisors, and either $\frac{7}{8}$ or $\frac{6}{7}$ cheek-teeth on each side; and they are further characterized by their broad and unwebbed fore-feet and fossorial habits. They are mole like in appearance and of small size. The Tibetan mole-shrew (*Uropsilus soricipes*) is the sole representative of a distinct genus differing from the last by having only thirty-four teeth, a narrow fore-foot, and a naked and scaly tail. In habit it is cursorial; and while in external appearance it resembles a shrew its skull and teeth are like those of a mole. Its general color is slaty gray.

THE WEB-FOOTED MOLES

Genus *Scalops*

With the web-footed moles of North America we come to the first representatives of the second section of the family, characterized by having the collar bone (clavicle) and the arm bone (humerus) so shortened and widened as to have lost all resemblance to the ordinary form; and also by the presence of an additional sickle-shaped bone on the inner side of the fore-foot, next to the thumb, both these features being intimately connected with the purely fossorial habits of all the members of this section of the family.

Structure All the moles, whether they belong to the New World or the Old World group, are characterized by their peculiar form, which, as we shall mention later on, is so admirably adapted for their mode of life. All have the fore-paws naked and of enormous width and strength; while in all there are no external ear-conchs, and the small and useless eyes are deeply buried beneath the fur, and are often further protected by an investing membrane. Then, again, these animals are characterized by the extreme thickness and density of their short velvet-like fur, to which no fragments of the soil through which the burrows are driven ever adheres. Like the New World moles, the web-footed moles are distinguished from their cousins of the Old World by the circumstance that the first incisor tooth in the upper jaw is of much larger size than the second. The special characteristics of the web-footed moles are that they have only 36 teeth, of which $\frac{3}{2}$ are incisors, $\frac{1}{2}$ canines, and $\frac{8}{8}$ cheek-teeth; and that the hind feet are webbed, and the tail is short and nearly naked.

Habits The common web-footed mole (*Scalops aquaticus*) doubtless received its specific name on account of its webbed hind feet, which led to the very natural inference that it was a swimming animal. But according to Dr. Hart Merriam, this is a complete misnomer, for not only is this mole "not known voluntarily to swim, but in the selection of its haunts it shows no preference for the vicinity of water, but manifests rather a contrary tendency. Its home is under ground, and its entire life is spent beneath the surface. Its food consists almost wholly of earthworms, grubs, ants, and other insects that live in the earth and under logs and stones. It is almost universally regarded as an enemy to the farmer, and is commonly destroyed whenever opportunity affords; for, notwithstanding the fact that its subsists upon insects that injure the crops, it is nevertheless true that, in the procurement of these, it disfigures the garden paths and beds by the ridges and little mounds of earth that mark the course of its subterranean galleries, and loosens and injures many choice plants in its probing for grubs amongst their roots." The nest of this mole, "is commonly half a foot or more below the surface, and from it several passages lead away in the direction of its favorite foraging-grounds. These primary passages gradually approach the surface, and finally become continuous with, or open into, an ever-increasing multitude of tortuous galleries, which wind about in every direction, and sometimes come so near the surface

as barely to escape opening upon it, while at other times they are several inches deep. Along the most superficial of these horizontal burrows the earth is actually thrown up in the form of long ridges, by which the animal's progress can be traced. The distance that they can thus travel in a given time is almost incredible. Audubon and Bachman state that they have been known, in a single night after a rain, to execute a gallery several yards in length; and I have myself traced a fresh one nearly one hundred yards. The only method by which we can arrive at a just appreciation of the magnitude of this labor is by comparison; and computation shows that, in order to perform equivalent work, a man would have to excavate in a single night a tunnel thirty-seven miles long, and of sufficient size to easily admit of the passage of his body."

THE HAIRY-TAILED MOLES

Genus *Scapanus*

The hairy-tailed moles, of which there are two species inhabiting the United States, form a connecting link between the web-footed and the star-nosed moles, having the general external appearance of the former, but the same number (forty-four) of teeth as in the latter. The habits of the common hairy-tailed mole (*S. americanus*) appear very similar to those of the web-footed moles; both inhabiting dry meadow land in preference to the swampy ground affected by the star-nosed mole. The mounds of the hairy-tailed moles do not, however, contain the central and surface opening of those of the web-footed moles; neither do the former animals indulge in the midday excursions so characteristic of the former.

THE STAR-NOSED MOLE

Genus *Condylura*

The last of the three genera of North American moles is represented only by a single species, the star-nosed mole (*Condylura cristata*), so called on account of the peculiar ring of riband-like appendages surrounding the end of the muzzle, in the middle of which are situated the nostrils. In addition to this feature, this mole is characterized by the tail being nearly as long as the body, and also by the circumstance that the bones of the terminal joints of the fingers are not cleft at their extremities, as they are in the Old World moles. Like the latter, the star-nosed mole possesses the typical number of forty-four teeth. In length this species measures about five inches, exclusive of the tail.

Habits

The food of this mole consists entirely of earthworms and insects, and its habits are very similar to those of the web-footed mole, although it does not apparently make such extensive excavations, and the hillocks thrown up from the runs are of larger size. In gardens and arable land these moles tunnel near the surface, throwing up a ridge of loose earth along the line of their

tunnels, but in pasture land they work at a lower level. In both these respects they resemble the common European mole, with which they also agree in that, during the late autumn, when the surface of the ground becomes frozen, they follow the worms downward until a plane is reached where the frost has not penetrated. By following the ridge of loose earth which marks the progress of one of these moles in a garden, and quickly sinking a spade in the creature's path, a few inches in advance of the moving earth, it is frequently possible to turn a specimen out upon the surface. So quickly, however, do these animals pass through the soft soil of a garden, that the spade, although aimed several inches in front of the moving earth, will not unfrequently cut them in two.

Although the precise function of the peculiar disc of tentacles round the muzzle is not yet definitely ascertained, it appears highly probable that it acts as a sensitive organ of touch to aid its owner in discovering the whereabouts of the worms and insects encountered during its subterranean wanderings. In the newly-born young these tentacles are so small as to be scarcely perceptible. A nest examined by Dr. Merriam contained three young ones.

THE TRUE MOLES

Genus *Talpa*

The Old World moles may be at once distinguished from all their North American cousins by having the first upper incisor tooth scarcely larger than the second. With the exception of a single species from Eastern Tibet, the whole of the Old World moles are included in the genus *Talpa*, of which the typical representative is the common European mole (*T. europæa*). The members of this genus, nine in number, are distributed over temperate Europe and Asia, two of the Asiatic species being found to the south of the Himalayas. As a rule, there is the typical number of forty-four teeth, but a few of the species have not quite so many, owing to the loss either of the lower canine tooth or of the first upper premolar; while in one species the first premolar is wanting in both jaws. All are characterized by the width of the fore-foot.



UPPER AND LOWER SURFACE OF
RIGHT FORE-FOOT OF MOLE.

As we entered at considerable length into the structure and habits of some of the American moles, our remarks on those of the Old World may be comparatively brief, as there is a great similarity between the two. It is remarkable that, as the European hedgehog differs from all the other species of its genus, so the European mole is distinguished from all its congeners by the absence of a membrane covering the eyes. Nearly or all the moles are normally black in color, with a more or less pronounced grayish lustre when viewed in certain lights; but pied, buff, or white varieties are not very uncommon. The naked feet are flesh colored. The different species of moles show considerable

variation as regards the relative length of the tail. Thus, whereas in the European mole the length of the head and body is about five inches and that of the tail one inch, in the Himalayan short-tailed mole (*T. micrura*) the naked tail is less than a quarter of an inch in length, and is completely concealed among the fur of the body.

Distribution The European mole is remarkable for its wide geographical distribution, ranging from England in the west, through Asia north of the Himalayas to Japan, and extending northward as far as the Altai mountains. Like its cousin, the common shrew, it is, however, unknown in Ireland. The "runs" of the European mole are very similar to those of the American moles already referred to, but the central chamber, or dwelling place, is of a more complex structure. As this dwelling place will be found described in detail in almost



THE COMMON MOLE.
(Two-thirds natural size.)

all works treating of the mole, it will suffice to mention here that it is usually placed near a hillock, or between two trees, and is composed of a central chamber with passages conducting to two circular galleries placed one above another. The higher of these two galleries has a smaller diameter than the lower one. From the larger lower gallery there are given off several diverging runs, one of which is larger than either of the others, and is known as the main run, being the one which alone leads to the burrows driven in various directions for the purpose of procuring food. These burrows, or runs, except when so close to the surface as to allow of the earth being raised directly upwards in the form of a ridge showing their course, are marked at intervals by the well-known "molehills," which are mounds of loose earth pushed up from below, and not containing any internal chamber or passages.

Since the voracity of the mole is proverbial, and its food consists exclusively of earthworms, insects, and their larvæ, its visits ought to be welcomed alike by the farmer and the gardener. As a matter of fact, however, the mole has an awkward habit of driving its tunnels below the drilled rows of young farm and garden crops, by which not only are the roots of the plants disturbed, but the whole row may be dried up. Moreover, it appears pretty certain that field voles will take advantage of runs driven in such localities as convenient points from which to make inroads on the sprouting seeds or the roots of the young plants. Then, again, in addition to the unsightliness of a host of molehills in a garden, such elevations are inconvenient in a field of standing grass, as they impede the process of mowing. From these and other circumstances, farmers and gardeners generally unite in a war of extermination against the mole, although there can be no doubt but that in many respects its visits are a distinct advantage to its destroyers.

It is well known that male moles are more numerous than females, and this seems to be explained by a writer in the *Field* newspaper, who states that a family "of moles appears to consist of five members, in the proportion of four males to one female—this as a rule, though with many exceptions. In the course of my experience I have never caught more than five in succession in the same run; and this, therefore, appears to be the limit." It is well known that moles have the habit of feeding at regular hours during the day, and that they may be found at work at eight, twelve and four o'clock. In regard to mole-catching, it is mentioned that, "when setting a trap in light, crumbling soil, as in a flower bed, care should be taken to remove only sufficient earth to allow of the trap being put in, and the hole leading each way should be carefully cleared, so as to allow the mole a free passage, or he will infallibly dive underneath your trap. A piece of slate put at the bottom of the run is a good preventive of this kind of thing." Like their North American relatives, moles swim well, and will take to the water readily.

According to Mr. Blanford, the short-tailed mole, which is abundant near the Himalayan station of Darjiling, at elevations of from about five thousand to eight thousand feet above the sea level, "inhabits the deep bed of black vegetable mold found wherever the original forest has not been destroyed. This mould contains earthworms and larvæ of insects, the chief food of moles, in abundance. Jerdon noticed that the runs of *T. micrura* often proceeded from the base of one great oak to that of another. Such runs are not marked by molehills, as in the case of the European species."

Extinct Moles Fossil moles are found throughout the Tertiary strata of Europe from the Upper Eocene deposits of Central France. As far down as the succeeding Lower Miocene beds these extinct species seem to belong to the existing genus *Talpa*, but the Upper Eocene species, on account of the arm bone (humerus) being rather less expanded, has been regarded as representing a distinct genus, *Protalpa*. The occurrence of these Tertiary moles is interesting, as they show how extremely ancient must be the insectivorous type of Mammals, since even at those early epochs the remarkable peculiarities distinctive of the skeletons of the existing members of the group had already attained their nearly complete development.

Yellow-Tailed Mole Our notice of the mole family may conclude by a reference to the yellow-tailed mole (*Scaptonyx fuscicaudatus*) of Eastern Tibet. This mole, which has only two pairs of lower incisor teeth, and consequently but forty-two teeth altogether, differs from the true moles in the considerably lesser width of the fore-feet, and thus approaches the mole-shrews noticed on p. 338.

THE TENRECS

Family *CENTETIDÆ*

With the curious-looking animal represented in the figure on the next page, we reach the first member of a group of Insectivores, comprising four families, which differ from all those yet noticed in the characteristics of their upper molar teeth. In all the preceding families the upper molar teeth have broad crowns, with their cusps arranged somewhat in the form of the letter W. On the other hand, in all those remaining for consideration, the crowns of these teeth are narrow, and carry on their crowns only three cusps, arranged in the form of the letter V. These cusps, or tubercles, thus form a triangle, with the apex directed inwardly; and this type of molar tooth, of which an example is represented in the accompanying illustration, is consequently known as the *tritubercular*. It may seem that such a point of distinction is of comparatively slight importance. Such, however, is by no means the case, since the researches of palæontologists have shown that nearly all the earlier Mammals had these tritubercular molar teeth, from which we infer that Mammals still retaining them in their primitive form belong to an extremely ancient stock.



CROWN SURFACE
OF AN UPPER
MOLAR OF THE
TRITUBERCULAR
TYPE.

From this and other structural peculiarities it may be taken as certain that the Insectivores of the present and three following families belong to a much lower type of organization than those already mentioned. And this is borne out in a remarkable manner by their geographical distribution. Africa and more especially Madagascar, are characterized by the number of Mammals belonging to ancient and primitive types still living there, as is well exemplified by the host of lemurs found in Madagascar. Now of the Insectivores with tritubercular molar teeth, the present and largest family is restricted to Madagascar and a few of the neighboring islands; a second is found both in Madagascar and Africa; the third is solely African; while the fourth is confined to the West Indies—a region also peculiar for the ancient types of its few Mammals. The whole of the tenrecs, which, as already mentioned, are confined to Madagascar and a few small islands in the vicinity, are characterized by their long skulls, which are not constricted between the eyes, and have no zygomatic arch below the socket for the eye to connect the upper jaw with the region of the ear, while the so-called tympanic bulla is in the form of a simple ring.

THE COMMON TENREC

Genus *Centetes*

This animal, which is the one represented in the illustration on this page, is readily recognized by its comparatively large size, and the total absence of a tail. It is the sole representative of its genus, and from the feature last mentioned, is technically known by the name of *Centetes ecaudatus*. Adult males attain a length of upwards of sixteen inches, and are thus the largest of all Insectivores. The body is covered with a mixture of flexible spines, bristles, and hairs; but whereas in the young the former are arranged in longitudinal lines down the back, in the



THE TENREC.
(One-third natural size.)

fully adult state they are restricted to a kind of collar round the upper side of the neck. The spines, bristles, and hair are yellowish or whitish towards the tips, and brown near the middle, so that the general color of the head and body is a kind of yellowish brown. When fully adult, the tenrec has 40 teeth, of which on each side $\frac{2}{3}$ are incisors, $\frac{1}{3}$ canines, and $\frac{7}{8}$ cheek-teeth. The tusks, or canines, of the males are very long and sharp, and would be capable of inflicting a severe wound. The most remarkable peculiarity connected with the dentition relates, however, to the upper cheek-teeth, and has only quite recently been discovered by Mr. O. Thomas. Thus in a middle-aged tenrec it will be found that there are six cheek-teeth behind the canine on each side of both jaws; three of these belonging to the premolars, or those preceded by milk-teeth, and three to the molar series, which

have no such predecessors. Very late in life, however, a small fourth molar appears in the upper jaw behind the other three. Considering that no other Mammals with teeth divided into distinct series, have four upper molars as a normal condition, except Marsupials, and one peculiar kind of dog, this is a very remarkable circumstance. Taken, indeed, in conjunction with the fact that both the tenrec and the carnivorous Marsupials have tritubercular molar teeth, while the skulls of both have certain very remarkable resemblances, this feature in the dentition renders it pretty certain that of all living Mammals the tenrec is the one which is most nearly related to the Marsupials of Australia and America. Further collateral evidence of this relationship is, perhaps, afforded by the circumstance that the tenrec produces a large number of young at a birth; although in this respect it even exceeds the Marsupials, an instance being recorded when as many as twenty-one young were brought forth at a single birth, fifteen or sixteen being the common number.

Habits Owing to its strictly nocturnal habits, our acquaintance with the mode of life of the tenrec is by no means so intimate as could be wished. It appears, however, that these animals are chiefly found in the mountains of Madagascar, where they inhabit low covert formed by ferns and bushes. Earthworms form a large proportion of their diet, which is, however, extensively supplemented by insects; and it would seem that the worms and insects are rooted out from their holes and hiding places by the aid of the flexible snout with which the tenrec is furnished. During the cooler season of the year the tenrecs hibernate for a long period, burrowing deep holes in the ground about May or June, from which they do not emerge till the following December. Whether this is to avoid a season of drought, when their natural food is difficult to procure, we are unaware. Like other animals, which enjoy a periodical rest, the tenrecs at the commencement of their hibernation are in a fat condition, and are then much sought after by the natives of Madagascar as an article of food; the whereabouts of their burrows being usually revealed by the heap of dirt or débris covering the entrance.

THE STREAKED TENREC

Genus *Hemicentetes*

The streaked tenrec (*Hemicentetes semispinosus*), together with a second nearly allied species (*H. nigriceps*), represent a genus distinguished from the preceding by having three, instead of two, upper incisor teeth, and probably only three upper molars; as well as by certain peculiarities in the structure of the skull, and the smaller size of the canine teeth, which are scarcely larger than the incisors, and cannot properly be termed tusks.

The streaked tenrec is an animal of about the size of the common mole, and derives its name from the streaks of black and yellow with which the body is ornamented. In this and the allied species the longitudinal rows of spines on the back, which disappear in the adult of the common tenrec, are retained throughout life.

The Hedgehog-Tenrecs The little animals known as hedgehog-tenrecs, are so like small hedgehogs in general appearance that they might be readily taken for members of the same family. Like hedgehogs, they have the whole of the upper surface and sides of the body covered with short, parti-colored bristles; and they are also furnished with a short tail. Of more importance as a generic characteristic, is the circumstance that there are only two incisor teeth on each side of both the upper and lower jaws. Although it is probable that these animals can to a certain extent roll themselves up into a ball, yet from the feeble development of the layer of muscle beneath the skin, Dr. Dobson is of opinion that this cannot be done so completely as in the case of the hedgehogs. Since it cannot be considered that the hedgehog-tenrecs are in any way nearly related to the hedgehogs, it is somewhat remarkable that both should have developed such exactly similar spines, which are used for defensive purposes in the same manner. The common hedgehog-tenrec (*Ericulus setosus*) is about two-thirds the size of the European hedgehog, and has thirty-six teeth. Telfair's hedgehog-tenrec (*E. telfairi*) is considerably smaller, with only thirty-four teeth, owing to the absence of the first pair of pre-molars in the upper jaw.

The Long-Tailed Tenrecs Two small mouse-like animals from Madagascar, each having forty teeth, are distinguished from all the preceding members of the family by the absence of spines mingled with the fur, and also by the great length of the tail. In one of the species (*Microgale longicaudata*) the length of the tail is double that of the head and body—a proportion only equaled among the pangolins. Of the 40 teeth, $\frac{3}{8}$ are incisors, $\frac{1}{4}$ canines, and $\frac{5}{8}$ cheek-teeth on either side.

The Rice-Tenrecs The last members of the *Centetidae* are the two small mole-like animals known as rice-tenrecs, distinguished by the extreme shortness of their tails, and likewise by their burrowing habits. The four-toed rice-tenrec (*Oryzorictes tetradactyla*) is peculiar in having but four toes on the fore-feet, of which the three innermost ones are armed with powerful claws for digging. The second species (*O. hova*) has five front toes, but both agree in having long, trunk-like snouts. These animals are a great pest to the agriculturists of Madagascar, owing to the damage they inflict on the rice crops by burrowing in the earth beneath the young plants in search of worms and insects.

THE SOLENODONS

Family SOLENODONTIDÆ

Strange as it may seem that the nearest relatives of the tenrecs of Madagascar should be found in a region so far removed from that island as the West Indies, yet it appears that the two solenodons really occupy this position; although in the form of the incisor, canine, and premolar teeth, they approximate very closely to the desmans (p. 337).

They have a total of forty teeth, corresponding serially with those of the long-tailed tenrecs; and they are distinguished from the *Centetidae* by the circumstance that the skull is somewhat narrowed between the eyes, and also by the mammae being entirely confined to the region of the groin, instead of extending on to the breast, as in all other members of the order. The snout is long, cylindrical, and trunk like, with the nostrils situated on each side of its extremity; the tail naked, cylindrical, and of considerable length; and the toes, especially those of the fore-feet, are armed with powerful curved claws. The fur covering the body is long and coarse. The Haytian solenodon (*Solenodon paradoxus*) is restricted to the island of Hayti, and was the first known of the two species. It may be compared in size to a small rabbit, the head and body measuring about twelve inches, and the tail about eight. The head and upper parts are brown, becoming blackish



THE CUBAN SOLENODON.
(One-fourth natural size.)

behind and on the thighs; while the sides of the head and under parts are lighter in color.

The Cuban solenodon (*S. cubanus*), is distinguished by the whole of the head, neck, and chest being tawny, or yellowish, while the remainder of the upper part and sides of the body is dark blackish brown. The nature of the fur is also somewhat different from that of *S. paradoxus*. It is found in the mountains of the southern and western portions of the island from which it takes its name, and it issues forth from its diurnal resting place during the late afternoon and early evening, to spend the night in search of food. From the readiness with which, when in captivity, it will tear in pieces meat that is offered to it, it may be inferred that in the wild state its food is not restricted to insects.

THE POTAMOGALE

Family POTAMOGALIDÆ

The curious aquatic Insectivore from West Africa, discovered by Du Chaillu, and named by him *Potamogale*, differs so much from all other members of the order that, like the solenodons, it forms the representative of a distinct family. *P. velox* may be recognized by its otter-like form, and long laterally compressed tail passing almost imperceptibly into the body. In size it is rather large for an Insectivore, the length of the head and body being eleven inches, and that of the tail nearly the same. It has a total of forty teeth, which have the same serial arrangement as in the long-tailed tenrecs, and are placed very near together. The head is characterized by the great width of the broad muzzle, which is provided with a number of large bristles, and has its nostrils closed by valves. The body is long and cylindrical, and the limbs are short, with the toes not connected by webs. The body is covered with a coarse outer coat of long hairs and an inner one of a finer and softer nature; the color of the upper parts being dark brown, while the under parts are whitish. In certain lights, however, the dark portion of the pelage is shot with a purplish metallic tint. The skeleton of the potamogale differs from that of all other Insectivores, except, probably, that of the undermentioned geogale, by the total absence of collar bones.

Habits The compressed

tail becoming cylindrical at its base to join the body, together with the presence of valves to close the nostrils, would alone suffice to indicate the aquatic habits of this curious creature. In addition, we have, however, the direct testimony of Du Chaillu, who observes that the potamogale "is found along the water courses of limpid and clear streams, where fish are abundant. It hides under rocks along these streams, lying in wait for fish. It swims



THE POTAMOGALE.
(One-fourth natural size.)
(After Allman.)

through the water with a rapidity which astonished me; before the fish has time to move it is caught. On account of the rapidity of its movements I have given it the specific name of *velox*. The animal returns to land with its prey almost as rapidly as it started from its place of concealment. The great motive power of the animal in the water seems to be in its tail."

Geogale Probably more or less closely allied to the potamogale is a small mouse-like Insectivore from Madagascar, described under the name of *Geogale*. This creature has thirty-four teeth, which resemble in form those of the potamogale, but our information is at present insufficient to render us certain as to its full affinities.

THE GOLDEN MOLES

Family *CHRYSOCHLORIDÆ*

The golden or Cape moles, constituting the genus *Chrysochloris*, are so different from all other Insectivores of this group that they are referred to a distinct family. They are entirely confined to South Africa, where they are represented by about seven species, and are commonly termed moles by the colonists.

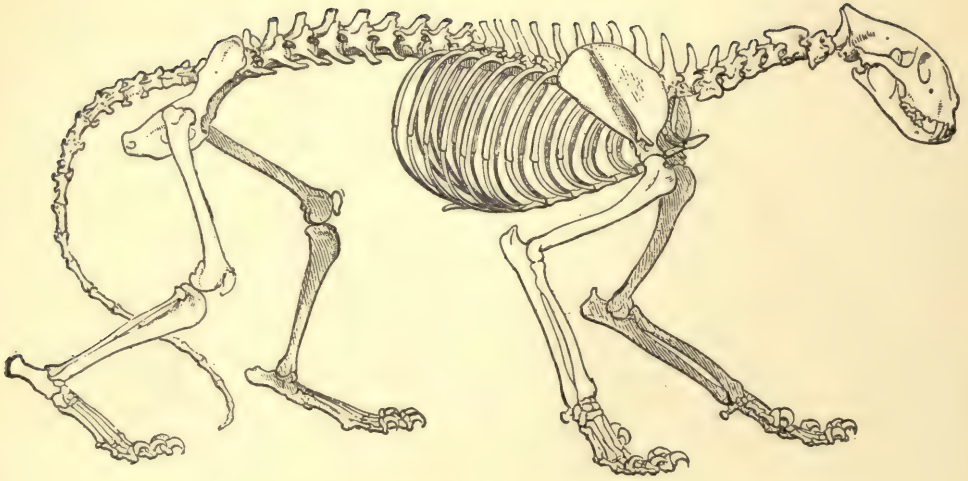
The skull of the golden mole differs from that of the tenrec in possessing a distinct zygomatic arch below the socket of the eye, and also in that its tympanic bulla is bladder like. In appearance these animals have some resemblance to the moles, but they have shorter and thicker bodies, with a deeper head and blunter snout. The whole form is, however, admirably adapted for tunneling through the ground : since the eyes are totally covered beneath the hairy skin, and the minute ears are deeply buried in the fur. While the hind-feet retain a normal form, the fore-feet have been specially modified for the purpose of digging, having only four toes, of which the two central ones are furnished with enormous triangular claws of great power. The more typical species have altogether forty teeth, but in others the number is reduced to thirty-eight, owing to the loss of the first pair of premolars in each jaw. The molar teeth have very tall crowns. The golden moles derive both their popular and scientific names from the brilliant metallic lustre of the fur, which shows various tints of green, violet, or golden bronze ; the brilliancy of these metallic hues being much intensified when the skin is immersed in spirit.

Habits The runs are made so near the surface of the ground that the earth is raised above the tunnel, which can accordingly be followed with ease in all directions. When one of the moles is seen to be at work, owing to the movements of the soil, it can readily be thrown up on to the surface by the aid of a stick or spade. The food of the golden moles consists mainly of earthworms.

The nearest relatives of the golden moles appear to be the tenrecs, while the ordinary moles are closely allied to the shrews ; and it is thus interesting to find two widely different groups of animals modified for a similar kind of subterranean life. This modification has, however, by no means followed the same lines in the two groups, for not only do the skeletons of the golden and true moles differ considerably from one another, but there is a still more marked difference in the form and structure of the fore-foot. Thus, whereas the fore-foot of the true mole has assumed the well-known hand-like form, with an additional sickle-like bone near the thumb, that of the golden mole, as we have just seen, is of a totally different type, the power of digging being mainly due to the enormous horny claws of its two middle fingers.



LION AND LIONESS.



SKELETON OF TIGER.

CHAPTER XIII

THE CARNIVORES—ORDER CARNIVORA

THE CAT TRIBE

Family *FELIDÆ*

UNDER the common title of Carnivores, or Flesh-eaters, zoologists include all the members of that extensive assemblage of placental* Mammals, comprising cats, civets, hyænas, dogs, bears, weasels, etc., together with their aquatic allies the seals and walruses. The name refers to their most distinctive habit, that of subsisting on the flesh of other animals; but it must by no means be assumed that all Carnivores are entirely or even chiefly flesh-eaters, the bears being notable exceptions. Neither must it be assumed, on the other hand, that the Carnivores are the sole flesh-eating Mammals; since, as we have seen, many of the Lemurs and Insectivores will eat the flesh of other Vertebrates, while one group of Marsupials is almost exclusively carnivorous. With the exception of the members of the last-named group, which are otherwise broadly distinguished, there is, however, no as-

*The term "placental" refers to the circumstance that the embryos of the higher Mammals are connected during intrauterine life with the body of the female parent by means of an organ called the placenta, through which the blood of the parent communicates with that of the offspring. The Marsupials have no such connection.

semblage of Mammals which is so generally carnivorous as the present one, and accordingly the name by which it is designated is the most appropriate that could have been selected.

There has been a considerable amount of—more or less unprofitable—discussion as to whether the Carnivores, or Apes and Monkeys, are entitled to occupy the highest place among Mammals. Putting man on one side, there can, however, be but little doubt that, for their particular mode of life, the higher Carnivores, both as regards their bodily structure and their brain power are fully as highly organized as the Apes; and to say that the one group is higher or lower than the other is thus practically an impossibility. A more just view is to compare the Carnivores and the Primates with two trees of different kinds, each of which has attained practically the same height, and bears fruit and flowers of an equally perfect development.

Had we to deal only with the existing forms of the animal kingdom, and if the seals and walruses were excluded (as is done by some zoologists) from the Carnivores, there would be no great difficulty in giving a short and concise definition which would at once distinguish the order from all the others. The seals and walruses differ, however, so markedly in the characteristics of their teeth, as well as in many other structural points, from the more typical Carnivores, while a number of extinct forms appear to connect the latter on the one hand with the Insectivores, and on the other with the Marsupials, that any such concise definition is impossible.

Among the characteristics common to all Carnivores, whether terrestrial or aquatic, the following are some of the most important. In all cases the toes are provided with claws, which are very generally sharp and curved, with no resemblance to nails. Then, again, the number of complete toes is never less than four to each foot, and is frequently five. And in no case is the first toe capable of being opposed to the other digits; so that a Carnivore can in no sense be said to have a *hand* in the popular acceptance of that term.

The teeth, in conformity with the flesh-eating habits of the great majority of the members of the order, are generally large and well developed; and are always divisible into incisors, tusks or canines, and cheek-teeth. As a general rule, the incisors are three in number on each side of both the upper and lower jaws, and in no case do they exceed this number;* while the third or outermost of these three incisors is always larger than either of the others, more especially in the upper jaw. The tusks are large, and adapted for seizing and retaining the prey of these animals. The different families of the order show a considerable diversity in the form and structure of the cheek-teeth; but, as a general rule, the more anterior of these teeth have sharp and more or less compressed crowns, while very frequently, as will be explained later on, one pair of teeth in each jaw is specially modified to bite with a scissor-like action against an opposing pair in the opposite jaw. Moreover, in such Carnivores as have the crowns of the molar teeth flattened and expanded, these crowns are not divided into distinct portions by infoldings of the enamel, as we shall find to be so frequently the case with those of the Rodents.

*The Marsupial Carnivores never have less than four pairs of incisor teeth in the upper jaw.

The most distinctive feature of the skull of the Carnivores is to be found in the mode of articulation of the lower jaw; the condyle or projecting process by which the latter hinges on to the skull proper, taking the form of a half cylinder, elongated in the transverse direction. This half cylinder is received into a similarly-shaped hollow—the glenoid cavity—in the skull, bounded by overhanging edges. In consequence of this arrangement, the motion of the lower jaw of a Carnivore is strictly limited to an up and down direction; thus allowing only of a biting or snapping action, and not permitting that rotatory or backward and forward movement found in so many other Mammals. The interlocking of the lower jaw with the skull is most marked in the badgers.

A less important feature of the carnivorous skull is to be found in the circumstance that in the great majority of instances the orbit, or the cavity for the eye, is not bounded posteriorly by a bar of bone so as to form a complete ring, but communicates freely with the greatly elongated hollow on the side of the skull which contains the powerful muscles for working the jaws. Occasionally, however, as in some cats and the ichneumons, the eye socket is completely surrounded by a bony ring; and a process at the back of the upper part of the cavity for the eye always marks the posterior limit of that cavity. More constant is the presence of a strong zygomatic arch bounding the inferior border of the socket of the eye, and connecting the upper jaw with the region of the ear.

An important feature distinguishing the skeleton of a Carnivore from that of an Insectivore (with the exception of the potamogale) is that the collar bones or clavicles are frequently absent, and when present are never complete; that is to say, that instead of each collar bone forming a bar to connect the shoulder blade with the breastbone, as in ourselves, when it exists at all it merely forms a little splint of bone embedded in the muscles of the chest between these two points.

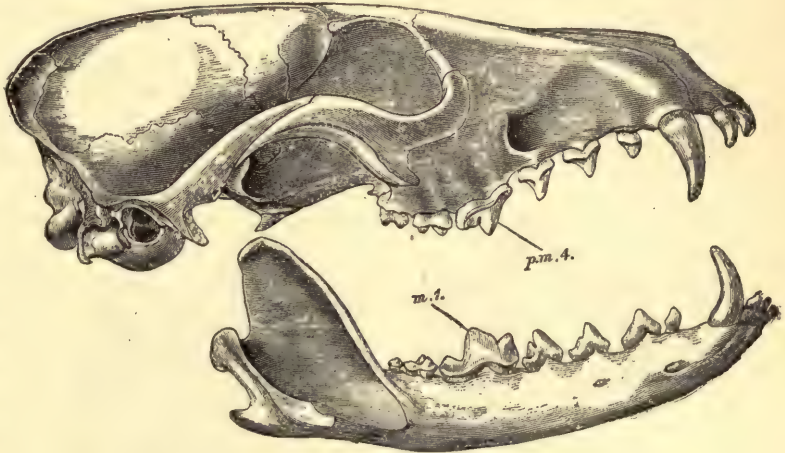
Two other features in regard to the skeleton must not be overlooked, since they are of some help in distinguishing between Carnivores and Insectivores. In many of the latter, as shown in the figure of the skeleton on p. 336, the two bones of the fore-arm (radius and ulna), and of the lower leg (tibia and fibula) are respectively united together, whereas in all the former they are completely separate. In the fore-limb this separation of the two bones is essential in order to permit of the free use of the paw. A characteristic of the wrist joint of all Carnivores is that two of the bones of the upper row, respectively known as the scaphoid and the lunar, are completely welded together; and it may be added that the central bone, which we have seen exists in all the lower Primates, is invariably absent. Another feature distinguishing the Carnivores from the Insectivores is to be found in the well-marked convolutions on the upper surface of the lobes of the brain, which is indicative of a far higher degree of mental power.

With the exception of Australia and New Zealand, Carnivores are distributed over all the continents and larger islands of the globe, ranging from the icy ocean of the Arctic circle to the tropical plains of Africa and India; but while some of the families, like the cats and dogs, have a distribution almost coextensive with that of the order, others, like the civets and hyænas, are much more restricted in

their range. Exclusive of the larger Man-like Apes, the Carnivores include the largest of the so-called Unguiculate Mammals, that is, those in which the toes are furnished with claws or nails, in contradistinction to hoofs. As is usually the case, the largest representatives of the order are to be found in the aquatic section, where we have the walrus and elephant seal. Among the terrestrial Carnivores the largest species are to be found in the warmer parts of the globe, although the bears form, to a certain extent, an exception to this rule. The more typical and purely carnivorous terrestrial members of the order, which, as a general rule, subsist on the flesh of animals killed by themselves, are characterized by the elegance and neatness of their build, and their bodily strength and activity, as well as by the fierceness of their disposition.

The terrestrial, or, as they are often called, in allusion to their free-toes, the Fissipede Carnivores, are, as a rule, adapted for a life on land, although some forms, like the otters, pass a large portion of their time in the water. In no instance, however, are their fore-limbs modified so as to assume the form of flippers, neither do their hind-limbs ever present the peculiar structure characteristic of those of the seals, being, on the contrary, invariably suited for walking with ease on the ground. Of more importance, however, is the structure of the teeth of the land Carnivores. In the

first place, the presence of three pairs of incisor teeth in both the upper and the lower jaw is an extremely constant feature. Then, again, instead of the uniformity pervading the whole series of cheek-teeth, which we shall find to be characteristic of the seals and their allies, the cheek-teeth of the terrestrial Carnivores of



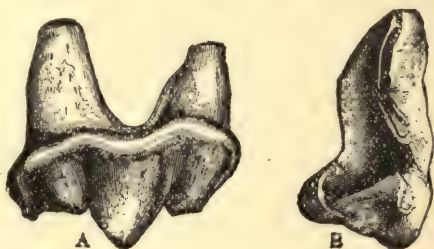
SIDE VIEW OF THE SKULL OF THE COMMON FOX.

To show the nature of the teeth of a Carnivore. The upper flesh-tooth is lettered *pm.4.* and the lower flesh-tooth *m.1.* (After Huxley, *Proc. Zool. Soc.*)

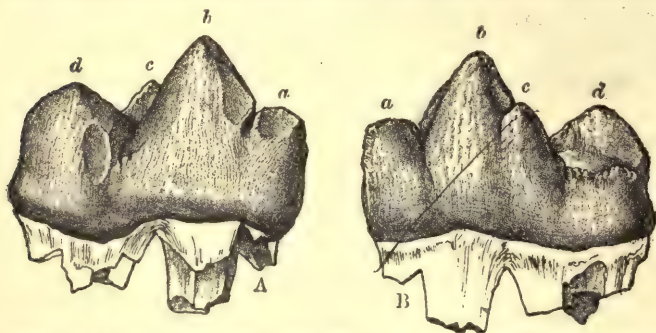
the present epoch are distinguished by having one of their number on each side of both the upper and the lower jaw modified in a special manner so as to bite against one another in a more or less markedly scissor-like fashion. The tooth in the upper jaw thus specially modified is the last of those which have milk, or deciduous predecessors, and is thus the fourth of the premolar series in those species where four of those teeth are developed. This is shown in the accompanying figure of the skull of the fox, where the fourth upper tooth (*pm.4.*) behind the tusk is the one specially modified. In the lower jaw, however, in those forms which have the full

number of teeth, it is the fifth tooth (*m.1*) behind the tusk which bites against the specially modified tooth in the upper jaw, as shown in the same figure. This modified lower tooth, which has no deciduous milk predecessor, is thus the first of the molar series. To these two pairs of modified teeth is applied the name of *flesh-teeth*, as being those specially adapted for cutting the flesh of the victims of the terrestrial Carnivores.

The upper flesh-tooth, as exemplified in that of the striped hyæna represented in the accompanying figure, consists of an outer blade, and of a strong tubercle on the inner side. The blade, as in the figured specimen, may consist of three lobes, or as in the dogs and civets, of only two such lobes, which bite on the outer side of the lower flesh-tooth, in a manner well known to all who have ever examined the skull of a tiger, lion, dog, etc. The lower flesh-tooth, of which an example is represented in the next figure, likewise has a large cutting blade on the outer side of its front portion, which is invariably divided into two distinct lobes, of which the second is generally the taller. In the more generalized Carnivores, such as the dogs, the second lobe of the blade of this tooth has a small cusp (*c*) on its inner side; while posteriorly the tooth is extended in the form of a long heel (*d*). The lower flesh-tooth of the more specialized forms, such as the hyænas and cats, consists, however, only of the



OUTER (A) AND ORAL (B) ASPECTS OF THE RIGHT UPPER FLESH-TOOTH OF THE STRIPED HYÆNA.



OUTER (A) AND INNER (B) ASPECTS OF THE RIGHT LOWER FLESH-TOOTH OF AN EXTINCT DOG-LIKE CARNIVORE.

a, b, first and second lobes of the blades; *c*, inner cusp of do.; *d*, heel.
(After Kittl.)

two-lobed blades, with or without a minute inner cusp and a small hind ledge representing the heel.

Under the general title of cats it is found convenient to include all the living representatives of the extensive family of the *Felidæ*, the whole of which with the single exception of the hunting-leopard, are classed in

the genus *Felis*. In this sense lions, tigers, leopards, jaguars, pumas, lynxes, and the smaller species more nearly allied to the domestic cat, are all designated Cats.

The members of the Cat family may be regarded as the ideal representatives of the Carnivores, being those most completely adapted in all parts of their structure for the pursuit and destruction of living prey. Their long, lithe bodies exhibit in its fullest perfection the combination of strength and agility distinct-

tive of Carnivores in general; while their strength is so great that the larger species are enabled to kill and drag away animals of far greater bulk than their own.

The essential characteristics of the living cats are to be found in the extreme shortness of their muzzles; in the reduction of the number of their teeth far below that in the more generalized Carnivores, such as the dogs; in the powerful development of their tusks and flesh-teeth; and in their strongly-curved and retractile claws, as well as in the free and supple movements of their fore-paws. Omitting mention of certain features distinctive of the skulls of the cats and their nearest allies, as requiring a considerable amount of special knowledge of osteology, we may particularize somewhat more fully the leading characteristics of the cats of the present day. And we say those of the present day advisedly, since the researches of palæontologists have now brought to light the remains of a large number of Carnivores, many of which, although they must undoubtedly be called cats, differ from the existing species by the greater number of their teeth, as well as by many other structural peculiarities, so as to render it difficult to draw any well-marked distinction between cats and civets.

We may first of all notice that, as a general rule, they have 30 teeth, of which $\frac{2}{3}$ are incisors, $\frac{1}{3}$ canines, $\frac{2}{3}$ premolars, and $\frac{1}{3}$ molars. Occasionally, however, there may be only two premolars on each side of the upper jaw, thus reducing the total number of teeth to twenty-eight. Thus a cat has at most only three or four cheek-teeth on each side of the upper jaw, of which the last but one is the flesh-tooth; while in the lower jaw there are but three of these teeth, of which the last is the flesh-tooth. The upper flesh-tooth is of the same general type as that of the hyæna's tooth shown in the figure on p. 356; its blade consisting of three distinct cutting lobes, and usually having a distinct tubercle on the inner side, although this tubercle is always smaller than in the hyænas, and may be wanting. The lower flesh-tooth is also of the same general type as that of the hyænas (of which an example will be found figured under the head of that group), and consists only of the two-lobed blade, without any trace of the inner cusp or hinder heel, which form such important elements in the corresponding teeth of the dogs and civets. The flesh-teeth of the cats have, indeed, lost the whole of those elements which are adapted for masticating or bruising food, and are reduced simply to the condition of cutters. Moreover, the single molar remaining in the upper jaw is of such small size that it can be of but little, if any, use as a masticating agent; and we accordingly find that the dentition of the cats is adapted solely for seizing their prey, and subsequently devouring it by cutting off the flesh from the bones by the scissor-like action of the flesh-teeth. Any person who has watched a domestic cat eating a piece of meat, or who has observed a captive lion or tiger shearing off huge morsels from its allotted meal, will fully understand the mode of action of these teeth. In all cats the tusks, or canines, are very long and strong, and frequently have their hinder border forming a sharp cutting edge, by which their rending power is of course much increased. An important feature distinguishing the lower incisor teeth of the cats from those of all other Carnivores is to be found in the circumstance that the whole series of six are placed in the same straight transverse

line, whereas in other Carnivores the second pair of these teeth is thrust up above the level of those on either side.

The fore-feet of all the cats are provided with five toes each, whereas the hind-feet have but four toes. The claws in which these toes terminate are invariably curved and sharp, and with the single exception of the hunting-leopard, can be completely retracted within sheaths for their protection when not in use. The mechanism of the retraction of the claws is due to the peculiar shape of the terminal joints of the toes, and the mode by which they are articulated to the second joints. Thus the terminal joint of each toe has the broad sickle-like form of the horny claw which it supports, and it is articulated to the end of the second or preceding joint only by the lower portion of its vertically expanded base. From the end of the second joint there runs a ligament to be inserted on the upper side of the base of the terminal joint, the ordinary action of which is to draw back the whole claw upon the upper surface of the second joint, when it becomes nearly concealed within its projecting sheath. To the under side of the base of the terminal joint there is, however, inserted the end of a long tendon coming from one of the so-called flexor muscles of the fore-leg. When the animal springs upon its prey the paw, in the act of striking, is sharply bent upon the wrist by the action of these flexor muscles, the result of which is to pull downwards the terminal joints of the toes, and thus to fully expose the claws. In order to keep their claws in good condition, most cats — from the tiger downwards to the domestic cat — are in the habit of drawing them down the bark of trees, whereby they are rendered sharp and clean.

All the species of cats walk solely upon their toes, and are hence termed digitigrade; the hinder part of the foot being entirely raised from the ground to form a continuation of the leg. This mode of progression indicates a higher specialization than the so-called plantigrade mode of walking in which, as exemplified by the bears, the whole of the sole of the foot is applied to the ground. Formerly the distinction between digitigrade and plantigrade Carnivores was regarded as an important one in classification, but it is now known that nearly allied groups vary greatly in this respect, and that the characteristic is a purely adaptive one. It has been already mentioned that the fore-feet of the cats are furnished with five toes. The innermost toe, corresponding to the human thumb is, however, placed at a much higher level than the other four toes, and is consequently of no use in walking. The missing toe in the hind-foot corresponds to the human great toe. The stealthy walk characteristic of all the cats is due to the soft cushions, or pads, on the under surface of the feet; each toe having a separate pad, behind which is a large pad occupying the middle of the sole of the foot. The fore-foot is thus furnished with six, and the hind-foot with five footpads. There is, however, on the fore-limb an additional pad on the outer side of the palmar aspect of the metacarpus. The impression, or *spoor*, of a cat's foot always shows the form and number of the pads, and it should be particularly noticed that in such impressions there is no mark of the claws, which in walking are completely retracted. This affords a ready means of distinguishing between the track of a cat and a dog.

In order to enable them to lick off the meat from the bones, and perhaps also to aid in cleaning their beautiful fur, the tongues of all the cats are furnished with

a number of flat processes, or papillæ, which are inclined backwards, and enable the tongue to act as a most effective rasp. In this respect cats again differ very markedly from dogs, in which the tongue is quite smooth; and it is probable that this difference may be accounted for by the fact that the teeth of the dogs are adapted for cracking and breaking bones, which are then swallowed; while those of the cats are not suited for this purpose, and the bones of their prey are consequently licked clean and left.

The fur of most members of the cat tribe is usually short, and of even length over the entire body; but the male lion is an exception in this respect, owing to the development of the large masses of long hair on the neck and shoulders. Such species as dwell in cold climates, like the ounce, have, however, much longer fur; and it is noteworthy that when a species, like the tiger, inhabits both hot and cold regions, the length of the fur varies according to the climate.

Very characteristic of all the cats are the long bristle-like hairs, commonly known as "whiskers," but technically designated "*vibrissæ*," fringing the muzzle. These hairs are provided with special nerves, and act as delicate organs of perception to aid the animals in finding their way, and detecting objects during their nocturnal wanderings. In correlation with these nocturnal habits the eyes of the cats are large and full, and their "pupils" can be altered largely in size by the contraction or expansion of the iris, according to the amount of light they have to receive. In most of these animals the ears are short and rounded at the tips, but in the lynxes, and some allied species, they are elongated by the addition of pencils of long hairs to their tips. The tail in the majority of cats is long, cylindrical, and capable of peculiar snake-like movements; these movements being brought into play when the animals are excited or in pursuit of their prey. In some of the smaller typical cats, and in all the lynxes, the tail is, however, relatively short; while in the lion it is furnished with a large brush of hairs at the tip.

The usual coloration of the members of the cat tribe takes the form of dark spots or stripes on a lighter ground; the ground color generally varying from shades of gray through tawny to yellowish or orange. The spots may be either simple, or in the form of rings or rosettes enclosing an area of darker tint than the general ground color of the fur. From these ringed spots there is a gradual transition, as is well displayed in the marbled tiger-cat, to stripes which are generally more or less vertical, and assume the most regular development in the tiger. In a few species, however, such as the lion and the puma, the entire coloration is tawny; but even then traces of spots may often be detected in certain lights, while the young are invariably spotted. From this it may be inferred that the uniform tawny coloration of such species is an acquired characteristic—probably originally adapted to the desert-hunting habits of the species in which it occurs—and that all the cats were primitively either spotted or striped. A black color among the wild members of the family is of comparatively rare occurrence, but it is met with among the leopards, and in certain other species.

In point of size, the members of the cat tribe present a greater degree of variation than is found in any other family of Carnivores; the larger species like the tiger and lion, being only equaled in bulk by some of the bears, while the smallest

member of the family — the rusty-spotted cat of India — is inferior in dimensions to the common domestic cat.

The total number of living species of the genus *Felis* may probably be reckoned at or about forty-one; and these have a distribution in space nearly coextensive with that of the entire order of Carnivores. They do not, however, extend so far northward as do the bears and the Dog family; and they are totally unknown in the island of Madagascar. The greater number of species — more especially those of larger size — are found chiefly in the tropical and subtropical regions of the globe; but the evidence of geology proves that the geographical range of some of these species was much more extensive at an earlier period than is the case at the present time. In respect of diet, the cats are purely carnivorous, and although when pressed by hunger some of them are known to eat the flesh of any dead animal they may come across, as a normal rule they kill their own prey. This is always effected by cautious stalking, followed by a sudden final rush; and, although it is said that two or more lions will occasionally combine to drive game in a given direction, when it can be seized by another member of the party, the cats almost invariably pursue their prey alone. The general antipathy of the cat tribe to water is proverbial, but in the swampy sandarbans of Lower Bengal, the tiger has often been observed swimming from one marshy island to another; and the fishing cat of India largely subsists on fresh-water fish captured by itself.

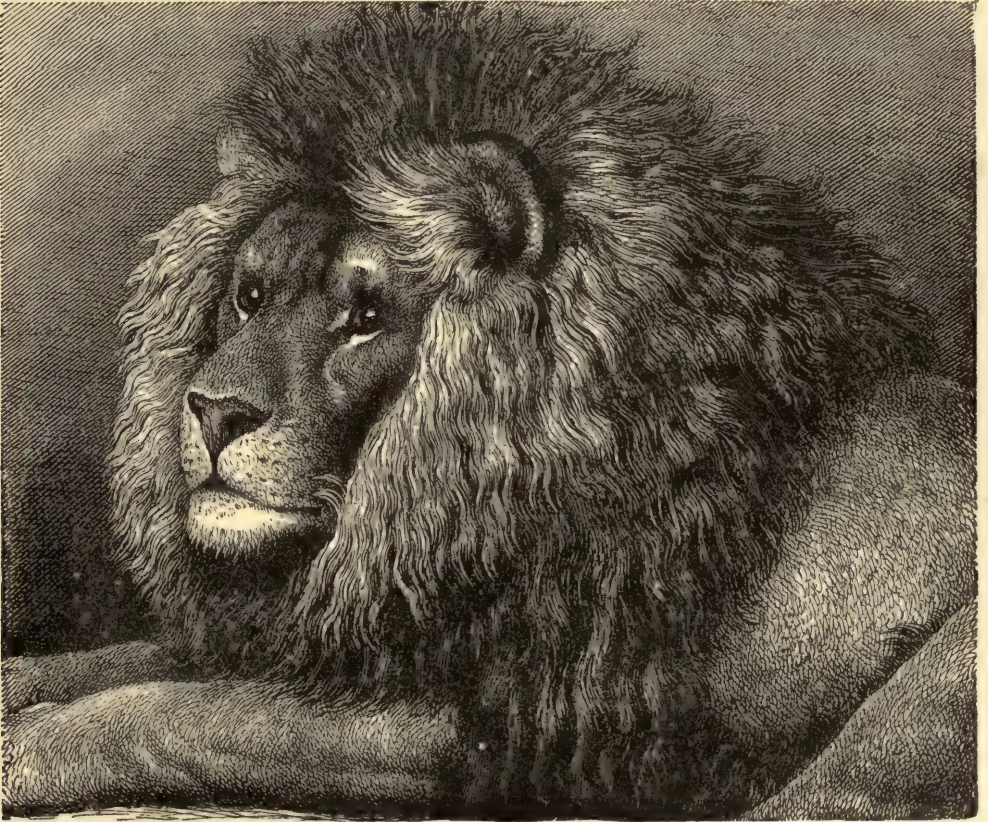
THE LION (*Felis leo*)

Till well on in the present century the title of “King of Beasts” was almost universally bestowed upon the lion by writers on natural history, on account of its generally majestic appearance, and the assumed nobility and fierceness of its character. Of late years, however, there has been a strong tendency on the part of those who have had the best opportunities of observing the animal in its native haunts, to depose the lion from the proud position it has so long occupied. The reasons for this change of view appear to be that when roaming abroad by daylight the lion, as Mr. F. C. Selous, the well-known African hunter, informs us, does not carry his head so high up as he ought to in order to be entitled to the epithet majestic; while his disposition, instead of being noble and fearless, is considered by Livingstone and other writers to be more correctly described as cowardly and mean. Although it is impossible to doubt the accuracy of such observations as to its true character, yet the magnificent proportions of the animal, coupled with the splendid mane decorating the head and chest of the males, render the lion by far the most striking in appearance of the whole of the cat tribe, and, indeed, of all the Carnivores.

In common with the other large cats of the Old World, the lion has the pupil of the eye circular; but it is at once distinguished from all the other members of the family by the long hair growing on the head, neck, and shoulders of the males to form the flowing mane. This mane varies considerably in size and color in different individuals, but, contrary to what has often been stated, is present in Indian as well as in African lions. Frequently, although by no means invariably, the long hair of

the mane is continued as a fringe down the middle line of the belly. Another distinctive characteristic of the male lion is the brush of long hair at the tip of the tail. In the middle of this brush of hair, at the very extremity of the tail, is a small horny appendage surrounded by a tuft. Much writing has been devoted as to the use of this so-called "thorn" in the lion's tail; one old story being that it was employed to rouse the animal to fury when the tail was lashed against the flanks.

The hair on the remainder of the body of the male lion, and on the whole of both the head and body of the female, is short and close. In the adults of both sexes



THE CAPE MANED LION.

the color of the body hair is the well-known yellowish brown, or tawny, but the tint varies in intensity in different individuals. The long hair of the male's mane may vary from tawny to a blackish brown. Young lion cubs are marked with transverse dark stripes running down the sides of the body, and likewise by a single stripe of similar tint along the middle of the back. In certain lights more or less faintly marked spots may be observed in many lions nearly or quite up to the period of maturity; these markings, as a rule, being more conspicuous in females than in males. The mane of the male does not make its appearance till the animal is about

three years of age, and continues to grow until the age of about six years. Although the full length of the period of a lion's life does not appear known, it has been ascertained that they will live to thirty, and it is said even to forty years.

Owing to the circumstance that the measurements of lions are frequently taken from skins, exaggerated notions of the length attained by large males have obtained currency. Mr. Blanford states that a male — presumably an Indian specimen — measured 8 feet 10 inches from the tip of the muzzle to the tip of the tail; 2 feet 11 inches of this being occupied by the tail alone. Mr. Selous, writing of South African lions, observes that "the following are the lengths of the pegged-out skins of six full-grown males shot by myself, and carefully measured with a tapeline: *viz.*, 10 feet 3 inches, 10 feet 6 inches, 10 feet 9 inches, 10 feet 10 inches, 9 feet 7 inches, and 11 feet 1 inch. These are the lengths of the skins after being pegged out and stretched out to a certain extent. However, after having flayed it, I carefully measured the naked carcass of the largest lion. From the top of the front teeth to the end of the tail it measured 9 feet 7 inches, laying the tape along the curves of the body, and as all the gristle and meat of the nose had been cut away with the skin, and at least an inch must have been lost with the tuft at the end of the tail, I think it would have measured all but 10 feet before it was skinned, even without making any allowance for the mane." Although Cornwallis Harris gave 10 feet 6 inches as the length of a large lion, Mr. Selous's estimate may be provisionally taken as representing the full size of the African type. Females are generally about 1 foot shorter than males. There is a dearth of information as to the height of a full-grown lion at the shoulder; but Mr. Blanford tells us that one measuring 8 feet 9½ inches in length, had a height of 3 feet 6 inches. A fine menagerie lion recently measured had a total length of 10 feet, of which the tail occupied 3 feet 2 inches.

Still more imperfect is the information relating to the weight of lions. Mr. Selous states that an African lion in poor condition shot in 1877 weighed 376 pounds; but a fine, well-nourished example killed later on weighed 500 pounds. This weight is, however, exceeded by a male shot in the Orange Free State in 1865, which on good evidence is reported to have weighed over 583 pounds. The menagerie specimen, of which the dimensions are given above, weighed 434 pounds. Sir Samuel Baker is of opinion that a lion would weigh more than a tiger of the same approximate dimensions; but against this may be set the opinion of Mr. Blanford, who considers that a tiger, although standing lower than a lion, is heavier in the body and more powerful.

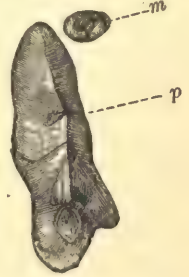
Before entering upon the consideration of the geographical distribution and habits of the lion, it may be well to point out how the skull of a lion may be readily distinguished from that of a tiger. In a lion's skull the so-called nasal bones, or those forming the roof of the cavity of the nose, have their superior termination on the forehead situated in the same transverse line as the terminations of the upper jawbones or maxillæ. In the skull of a tiger on the other hand, the upper extremities of the nasal bones extend considerably higher up on the forehead than do those of the upper jawbones. The skull of a lion may also be distinguished from that of a tiger by the much smaller size of the tubercle on the inner side of

the upper flesh-tooth. Thus, whereas in the tiger this tubercle is but little smaller than in the corresponding tooth of the hyæna, figured on p. 356, in the lion it more nearly approaches the condition obtaining in the tooth of an extinct cat, represented in the accompanying figure although it extends nearer to the front edge of the tooth. The skull of an adult male lion may measure as much as thirteen inches in extreme length, with a breadth across the widest part of the cheek bones of nine and one-half inches.

The present range of the lion includes the whole continent of Africa, from the Cape Colony to Abyssinia and Algeria, although in many of the more civilized districts the animal is now greatly reduced in numbers, or even completely exterminated. In Asia it is found through Mesopotamia and South Persia to the northwestern districts of India, being, however, now on the verge of extinction in the latter country. Formerly, even within historic times, the lion had a much more extensive geographical range, extending westward into Syria and Arabia, and ranging over a considerable portion of Southeastern Europe, such as Roumania and Greece. This, however, by no means limits the original extent of its range, for bones and teeth found in the caverns and superficial deposits of Western Europe prove that lions, which appear specifically undistinguishable from the existing form, once roamed over Germany, France, Italy, Spain, and the British Isles. The ancient prehistoric lions of Western Europe were in all probability exterminated by the cold of the glacial period; but the destruction of those infesting Eastern Europe and parts of Western Asia during the historic epoch was probably effected, at least to a considerable extent, by human agency.

In South Africa lions are now scarce in the districts to the southward of the Orange river, but are locally abundant in the regions farther north, such as Mashonaland. Although it is quite probable that its range may once have embraced the countries of Afghanistan and Baluchistan, the lion is now quite unknown in Asia to the northward of India. Writing some years ago of the habitats of the lion in Western Asia, Canon Tristram observes that "the Arabs say it is found in Arabia; but of this we have at least no evidence. Occasionally it crosses the Euphrates, and a few years ago a lion's carcass was brought into Damascus. Between the Lower Tigris and Euphrates they still abound. Mr. Layard saw them frequently, and during his excavations in the neighborhood of Babylon, found fresh traces of their footsteps almost daily among the ruins. It extends also far higher up, to the jungle of the Khabour, or Chebar, on the upper Tigris, above Mosul and Nineveh (the ancient Chebar), where Layard mentions an Arab being attacked by one, and escaping with the loss of his mare."

The late Sir O. B. St. John, as quoted by Mr. Blanford, observes that "lions, which are very numerous in the reedy swamps bordering the Tigris and Euphrates, are found also in the plains of Susiana, the modern Khuzistan, and extend into the mountain country south of Shiraz as far east as longitude 53°. I have no accurate



THE LEFT UPPER FLESH-TOOTH (*p*) AND MOLAR (*m*) OF AN EXTINCT SABRE-TOOTHED TIGER.

The projection on the side of the lower part of the figure is the inner tubercle of the flesh-tooth.

information of their northern limits, but Captain Pierson, who spent many years in the country between Tehran and Baghdad, tells me that he never heard of lions in the oak forest west of Karmanshah. It is the acorns of this same oak forest which feed the wild pigs whose presence tempts the lion into the mountains of Fars. . . . The little valley of Dashtiarjan, thirty-five miles west of Shiraz, is notorious for the number of lions found in its vicinity. Part of the valley is occupied by a fresh-water lake, on the edges of which are extensive beds of reeds; the surrounding hills, which rise some four thousand feet above the valley, itself six thousand five hundred feet above the sea, are covered with oak forest, or with pretty thick brush-wood of hawthorn, wild pear, and other bushes, and contain very extensive vineyards. Dashtiarjan is thus a perfect paradise for swine, and they increase and multiply accordingly, so that the lions have plenty to eat, varying the monotony of constant pork with an occasional ibex, or with a calf from the herds which graze in the valley. Every year some four or five lions are killed in Dashtiarjan or the neighborhood, and a few cubs brought into Shiraz for sale."

With regard to the lion in India, Mr. Blanford states that "there are probably a few still living in the wild tract known as the Gir, in Kattywar, and a few more on the wildest parts of Rajputana, especially southern Jodhpur, in Oodeypur, and around Mount Abu. About twenty years ago lions were common near Mount Abu, several were shot near Gwalior, Goona, and Kota, and a few still existed near Lalotpur, between Saugor and Jhansi. One is said to have been killed near Goona in 1873. In 1864 one was killed near Sheorajpur, twenty-five miles west of Allahabad; and when the railway was being made from Allahabad to Jabalpur in 1866, a fine lion, with a good mane, was shot by two of the engineers, near the eightieth milestone from Allahabad. About 1830, lions were common about Ahmedabad. Several years previously, in the early part of the century, lions were found in Hurriana to the northward, and in Khandesh to the south, in many places in Rajputana (one was shot in 1810, within forty miles of Kot Deji, in Sind), and eastward as far as Rewah and Palamow. It is probable that this animal was formerly generally distributed in Northwestern and Central India." A few years will probably witness the extinction of the lion throughout the peninsula. It is noteworthy that the lion, unlike the tiger, has never been known in the Malayan region, or, indeed, anywhere to the eastward of the bay of Bengal.

For a long period it was considered that the Indian lion differed from its African relative by the total absence of the mane in the male, which was hence regarded as indicating a distinct species. Moreover, owing to the differences in the length and color of the manes of African lions from different districts, it was likewise held that there were two or more species in Africa. It, however, has been definitely settled that such variations are not constant, and that there is but a single species. Although it may be that some adult specimens of the Indian lion are maneless, yet well-maned examples have been killed, while those which were stated to prove the existence of a maneless race are now known to have been immature individuals.

With regard to the variations of the African lion, Mr. Selous says that the Dutch hunters maintain the existence of from three to four distinct species, which

they assert themselves to be capable of recognizing. "For my part," adds Mr. Selous, "and judging from my own very limited experience of lions, I cannot see that there is any reason for supposing that more than one species exists, and as out of fifty male lion skins scarcely two will be found exactly alike in the color and length of the mane, I think it would be as reasonable to suppose that there are twenty species as three. The fact is that between the animal with hardly a vestige of a mane, and the far handsomer but much less common beast, with a long flowing black mane, every possible intermediate variety may be found." It is then stated how the narrator on one occasion shot two old male lions, which he found lying together under the same bush, both of which agreed as near as possible in size, but while the one was full maned, with a very dark-colored fur, the other was very yellow and had but little mane. Shortly after, Mr. Selous, with a brother sportsman, again met with a dark, full-maned lion in company with a nearly maneless light-colored one. Of still more importance is the account by the same hunter of his killing a lioness with three unborn cubs, of which two were males and one a female. "Of the two male cubs," says Mr. Selous, "the one, owing to the dark color of the tips of the hair, was almost black, while the other was reddish yellow. The skin of the female cub was also of a light color. Now I firmly believe that the two male cubs would have grown up, the one into a dark-skinned, black-maned lion, the other into a yellow lion, with but little mane; and further than this, I believe that the two pairs of males I have mentioned above were cubs of the same litters, and had been hunting in couples since their cubhood." These observations, which have been supplemented by others made on captive specimens, may be considered to definitely settle the question as to the specific unity of all African lions.

In spite, however, of the impossibility of specifically distinguishing between lions of different coloration, or between those inhabiting different regions of the country, it seems quite probable that the lions of one district may differ to a certain extent in some respects from those of another. Thus it seems pretty well ascertained that the lions from the Cape and Algeria have, collectively, larger and finer manes than those from other districts. Moreover, Gordon Cumming states that the manes and coats of lions inhabiting open, treeless districts, like the great Kalahari desert of South Africa, are fuller and handsomer than in those inhabiting forest districts. It has hence been considered that the manes of forest-dwelling lions are reduced in thickness by being torn by thorns and bushes. This theory is, however, considered untenable by Mr. Selous, who states that the lions of the open plateaux of Matabeleland and Mashonaland, where scarcely a thorn bush is to be seen, exhibit every degree of variation in regard to the length and color of their manes, and that a similar variation holds good for the Tati country, which is thickly covered with thorn-jungle. The variation in the length of the mane seems, therefore, at present not accounted for.

Before leaving this subject, it may be mentioned that, according to the experiences of the hunter from whom we have already so largely quoted, that wild lions—at least in the districts over which he shot—never have such long and heavy manes or such good coats as the majority of those met with in European menageries. Moreover, while all the wild lions with good manes, which came under the notice of

Mr. Selous, had a small tuft of hair on the elbow and another in the armpit, none were seen with the fringe of long hair along the middle of the under surface of the body, which is so universally present in maned menagerie lions. "I do not say," observes Mr. Selous, "that cases do not occur of wild lions becoming equally hairy; but they must be very rare, otherwise I should have met with some amongst the large number of skins I have seen. The coat of the wild lion is very short and close, whilst that of lions kept in this country becomes very much longer, and usually of a redder color than the pale yellow or silvery-gray hue of the wild animal. I could pick out the skin of a menagerie lion from amongst a hundred wild ones. Climate and regular feeding must, I think, have a good deal to do with the luxuriant growth of mane invariably to be observed in lions in confinement." As our pictures



THE LION AT A POOL.

and figures of lions are almost invariably taken from such captive specimens, it is obvious that an exaggerated idea of the size and beauty of the mane is commonly current.

Habits

The literature relating to the habits of lions is so extensive that the great difficulty an author has to contend with is in determining what to select and what to reject. Moreover, it will be found that in comparing the accounts given by different observers there is considerable diversity between them in regard to certain points. This difference, as observed by the Hon. W. H. Drummond, is doubtless due, to a certain extent, to differences in the habits of lions from different districts; but to this must be added the "personal equation" of the various observers.

With regard to the habits of lions, it is probable from the uniformly tawny color of these animals that they were primitively inhabitants of more or less completely desert or sandy regions, although they are now by no means restricted to such localities. In Africa, as Gordon Cumming relates, lions were formerly abundant in the sandy wastes of the great Kalahari desert; while they are now, according to Mr. Selous, equally plentiful in the high open country of Mashonaland, among the rough broken hills through which the tributaries of the Zambesi make their way to the main river, in the dense thorn-jungles lying to the west of the Gwai river, or in the marshes of the Linyanti river. Then again, whereas the Indian lion was formerly abundant in the sandy plains of Rajputana, the favorite haunts of the animal in Mesopotamia, are, as we have seen, in the swampy lowlands of the Tigris and Euphrates valleys.

Like most of the larger cats, lions are essentially nocturnal in their habits, and they are thus frequently only met with by chance in districts where, from the abundance of their tracks and from their nocturnal roarings, they are known to be plentiful. During the daytime they are accustomed to lie asleep in thick beds of reeds, where such are to be found, or, in drier districts, among thickets and bushes. "The most likely places in the bush country in which to find lions," observes Mr. Drummond, "as far as my experience goes, as the rekabee thorns, the dense evergreens which line the rivers, and, during summer, the reeds on the margins of lagoons or streams, while in the open flats any patch of reeds or tall grass suffices to conceal them. The best chances for killing them are obtained in the first-mentioned spots, as you often come across them asleep when you are stealing about after game." From these and similar haunts, the lion issues forth at sundown to commence his nightly prowls; dark and stormy nights, according to Gordon Cumming, being those on which he is most active, while he is more cautious during bright moonlight nights, especially as regards his visits to the drinking places.

Unlike most of his congeners, the lion is not a climber, and this general inability to ascend trees has saved the lives of many sportsmen and travelers, although not unfrequently at the cost of a long and thirsty waiting.

Mr. Blanford, who has had the opportunity of observing both lions and tigers in their native haunts, is of the opinion that the former are bolder than the latter, while they are certainly far more noisy. When relating the results of his experiences during the Abyssinian Expedition, he observes that "the first peculiarity that struck me in the African lions was their noisiness. I have constantly been for months together in countries in India abounding in tigers without hearing their cry. Indeed, it is by no means a common sound in any Indian forest. Leopards, I should say, are much more frequently heard than tigers. The cry of the two animals, commonly known as roaring, though it is utterly different from the harsh growl of anger to which the term might most appropriately be applied, is very similar, and consists of several deep notes uttered rather quickly one after the other, and repeated at longer and shorter intervals."

Very different impressions appear to be produced on different persons by the lion's roar, some listeners appearing to regard it as a rather commonplace and by no means awe-inspiring sound, while others, and we believe the majority, speak of it in

far different terms. Such differences of impression must, it is obvious, be largely due to personal disposition.

Perhaps the lowest estimation of the lion's roar is that of Livingstone. He writes that "it is calculated to inspire fear when heard in a pitchy dark night amidst the tremendous peals of an African thunderstorm, and the vivid flashes of lightning which leave on the eye the impression of stone-blindness, while the rain pouring down extinguishes the fire, and there is neither the protection of a tree nor a chance that your gun will go off. But when anyone is snug in a house or a wagon, the roar of a lion inspires no awe. A European cannot distinguish between the note of a lion and that of an ostrich. In general the voice of the former seems to come deeper from the chest; but to this day I can only pronounce with certainty from which of the two it proceeds, by knowing that the ostrich roars by day and the lion by night. The natives assert that they can detect a difference at the beginning of the sound."

A recent writer on *Land and Water*, who is fully impressed with the grandeur of the lion's roar, is by no means disposed to admit the justness of its comparison to the voice of the ostrich. He observes that when a lion is "roaring loudly in concert with others at a short distance off, the sound is grand and awe-inspiring in the extreme; in fact, I have never heard anything of a similar nature that can compare with it, for it is no exaggeration to say that the ground actually trembles with the volume of sound. I say this unhesitatingly, for all that many people would have us believe to the contrary, maintaining that there is nothing in it, and endeavoring to compare it to the 'booming' of the cock ostrich. At a great distance, and therefore, when heard indistinctly, the low, sullen roaring of a single lion has certainly much resemblance to the sound emitted by the ostrich during the pairing season; but persuade either the lion or the ostrich to come nearer, and one might then as well try to compare the rumbling of cart wheels over a wooden bridge with the incessant roll of thunder among mountains. But a lion makes other sounds far more disconcerting—because usually only heard at close quarters—than that to which it gives vent when, in company with others, it has killed a head of game, or is retiring to its lair, full fed. There is the constant low growling of the lion crouching in cover, uncertain whether to fight or to fly, as, with flattened ears and nervously twitching tail, he studies the situation, hoping by his attitude to warn off the disturber of his solitude. There is the angry snarl of the lion disturbed at his meals, when his appetite is not yet satisfied, and when one has come upon him so suddenly as to give him no time to clear off; and, worse than all, the short, coughing grunts which often accompany a charge, and which startle the intruder in his domains as he bounds away. All these sounds are by no means musical, and, whether heard by day or by night, are well calculated to try the nerves." Similar testimony as to the impressiveness of the lion's roar is given by Gordon Cumming, who describes it as consisting at certain times of five or six repetitions of a low, deep moaning, ending off with a faint and scarcely audible sigh, while at others it takes the form of loud, deep-toned, solemn roars, quickly repeated, and increasing in intensity till the third or fourth, after which it gradually dies away in a succession of low muffled growlings, like the roll of distant thunder. Then, again, the veteran

hunter, Sir Samuel Baker, gives his impressions in the following words: "There is nothing so beautiful or enjoyable to my ears as the roar of a lion on a still night, when everything is calm, and no sound disturbs the solitude except the awe-inspiring notes, like the rumble of distant thunder, as they die away into the deepest bass. The first few notes somewhat resemble the bellow of a bull; these are repeated in slow succession four or five times, after which the voice is sunk into a lower key, and a number of quick short roars are at length followed by rapid coughing notes, so deep and powerful that they seem to vibrate through the earth."

This vibrating and reverberating sound alluded to in the last sentence is intensified by the habit lions often have of putting their mouths close to the ground while roaring; Livingstone mentioned an instance where a lion stood for hours roaring near his camp, and making the sound reverberate in this manner.

The intensity and grandeur of the sound must, however, be largely increased, when, as is not unfrequently the case, a party of lions are heard roaring in concert; and the din reaches its height when two or three troops of lions approach a watering place at the same time. On such occasions, says Gordon Cumming, "every member of each troop sounds a bold roar of defiance at the opposite parties; and when one roars, all roar together, and each seems to vie with his comrades in the intensity and power of his voice."

As a rule, lions commence to roar with the falling shades of evening, and continue with longer or shorter intervals throughout the night; but Gordon Cumming states that in secluded and undisturbed districts he has frequently heard the roaring sustained as late as 9 or 10 o'clock in the morning on bright and sunny days. During cloudy and rainy weather they will, however, roar, although in a lower tone, throughout the day.

Although in some districts lions are commonly met either alone, or in pairs of males and females, this does not seem to be generally the case in the interior of South Africa, where, according to Mr. Selous, it is more usual to meet with four or five lions consorting together, while parties of from ten to twelve are by no means rare. Such a party of twelve would, in the experience of the same observer, probably comprise about two adult males, three or four full-grown lionesses, and half a dozen large cubs, which, except for their somewhat slighter build, might easily be mistaken for mature females. On one occasion Mr. Selous mentions that he came across a party consisting of a lion, three full-grown lionesses, and three small cubs; and he adds that if each of these females had possessed a pair of large cubs, such an assemblage would have been rightly termed a party of ten lions. It was probably such a party, although comprising more adult males, that Lord Randolph Churchill encountered during his recent journey in Mashonaland, when in company with his hunter Lee. "We were riding along," writes his lordship in his *Letters from Mashonaland*, "through a small open glade covered with high grass, Lee a few yards ahead of me, when I suddenly saw him turn round, cry out something to me, and point with his finger ahead. I looked, and saw lolling along through and over the grass, about forty yards off, a yellow animal about as big as a small bullock. It flashed across me that it was a lion—the last thing in the world that I was thinking of. I was going to dismount and take aim, for I was not frightened at the idea of

firing at a retreating lion, but Lee called out in succession five or six times, 'Look! look!' at the same time pointing with his finger in different directions in front. I saw, to my astonishment, and rather to my dismay, that the glade appeared to be alive with lions. There they were, trooping and trotting along ahead of us like a lot of enormous dogs—great yellow objects, offering such a sight as I had never dreamed of. Lee turned to me and said, 'What will you do?' I said, 'I suppose we must go after them,' thinking all the time that I was making a very foolish



THE MANELESS LION FROM SENEGAL.
(One-fourteenth natural size.)

answer. This I am the more convinced of now, for Lee told me afterwards that many old hunters in South Africa will turn away from such a troop of lions as we had before us. We trotted on after them a short distance to where the grass was more open, the lions trotting along ahead of us in the most composed and leisurely fashion, very different from the galloping off of a surprised and startled antelope." Lord Randolph Churchill himself counted no less than seven lions, while his hunter believed that there were several more in the party.

When a male lion has selected a female partner the union very generally lasts for the greater portion or the entire lives of the pair. From the evidence of specimens kept in captivity it is known that from two to six cubs may be produced at a birth, at least in the captive condition. It is stated, however, that in India wild lionesses do not produce more than two or three cubs at a birth; and Mr. Selous is of opinion that three is the usual number in South Africa, where many cubs appear to die while still very young. Lions breed freely in captivity, but not so readily in some menageries as in others. Thus, whereas in the London Zoological Gardens the number of cubs bred and reared is comparatively small, in those at Dublin it is very large; and many of the lions exhibited in various menageries have been reared at the latter establishment. It is a curious fact that lion cubs are born with their eyes fully open.

When caught young, lions are easily tamed, and the whole disposition of the animal in captivity is much more gentle than is that of the tiger.

That adult lions will combine to attack large animals that they would find it difficult or impossible to overcome unaided, is now well ascertained. The best known instance is one observed by Major Vardon and Mr. Oswell in South Africa, when three full-grown males united their efforts in endeavoring to pull down an old buffalo. When first observed the four animals were engaged in a terrific combat, the final issue of which might have been doubtful, had it not been terminated by the sudden death of the buffalo from the effects of a bullet wound it had previously received from the rifle of one of the witnesses. No sooner, however, did their prey succumb, than the three lions commenced to quarrel among themselves; one reared to half its height, resting its paws upon the middle of the carcass, while the other two respectively placed themselves at the head and tail, and growled forth defiance at the one in the middle. What might have been the result of the dispute can only be imagined, as two of the lions were shot, while the third, thinking discretion the better part of valor, prudently retired.

Another instance of a somewhat similar encounter is related by Sir Samuel Baker, who states that a Bavarian hunter in his employ, named Johann Schmidt, was on one occasion wandering along the bank of the Royan river in Abyssinia, when his attention was attracted by the sounds of a scuffle taking place at a water-hole. "The dust was flying high in the air, and as he approached the spot, within the yellow surface of the river's bed, he saw a cloud of sand, in the centre of which was the large body and long neck of a bull giraffe struggling against the attack of two lions. One of these was fastened upon its throat, while the other was mounted upon its hind-quarters, where it was holding on with teeth and claws. . . . The giraffe had no chance, and after a sharp struggle, before the well-concealed spectator, it was pulled down, and both lions commenced to growl over their contested prey."

Although in both the foregoing instances the lions, after securing their prey, commenced to quarrel among themselves, it does not appear that such quarrels always occur in similar circumstances, since Gordon Cumming relates how he once saw no less than six lions feeding peaceably upon the carcass of a rhinoceros.

From this part of our subject we are naturally led on to the consideration of the ordinary food of lions, and the manner in which they attack the larger animals upon which they prey. It has been already mentioned that in the oak forests of Persia the staple food of the lions is formed by the wild pigs which frequent these woods. In India Mr. Blanford states that lions usually feed on deer, antelope, wild pigs, cattle, horses, donkeys, and camels; and that formerly a large number of the latter were destroyed by them. In Africa lions appear to prey largely upon antelopes, zebras, quaggas, buffaloes, and giraffes. Mr. Drummond states that on the many occasions on which he has seen lions hunting by daylight, he cannot recall one when they were not in pursuit of buffaloes, and he has known herds of those animals which he had been hunting during the day scattered and dispersed by lions at night. On the other hand Mr. Drummond would not commit himself to the statement that buffalo meat forms the staple food of the South African lion. "Were a zebra, a fat rhinoceros, and a fat buffalo to be killed and left out, it is probable that they would be eaten in the order I have named. Soft succulent fat is what the lion probably considers most toothsome, and zebras supply this in a higher degree than any other animal, save the rhinoceros and the hippopotamus, neither of which he is able to kill; but on the other hand, the zebra . . . confines himself to the open, as far as possible, never approaches within springing distance of a thicket, and rarely, unless when going to water, gives the lion a chance. Buffaloes, on the other hand, are nearly always in and close to cover, presenting continual opportunities for a successful stalk; and though the danger in attacking them is much greater, as is proved by the no means rare instances of lions being maimed, and even killed in such contests, yet for the above reason they form their chief food."

It must not, however, be supposed that lions by any means restrict themselves to the flesh of animals which have fallen to their own attacks. The writer last quoted mentions their partiality for the flesh of rhinoceroses, which they are unable to kill themselves, and states that as many as eight or ten have been seen tearing at once at the flesh of one of those animals that had been shot by a hunter of his own. This is confirmed by the statement of Gordon Cumming already mentioned.

In addition to eating the flesh of animals recently killed, lions will also prey upon carcasses in an advanced state of decomposition. This fact was stated long ago by Gordon Cumming, and is fully supported by the observations of Mr. Selous. The latter writer states that when elephants have been shot, "lions will prey upon the stinking carcasses as they lie festering in the rays of a tropical sun, and at last become a seething mass of maggots, returning night after night to the feast, until no more meat is left. This occurs in parts of the country abounding in game, where it would give a party of lions but little trouble or exertion to catch a zebra, buffalo, or antelope, and procure themselves a meal of fresh meat. In the same way, no matter how plentiful game may be, lions will almost invariably feast upon any dead animal left by the hunter, from a buffalo to a steinbock, that they may happen to come across."

Near villages, when lions grow too old to be able to take game for themselves, Livingstone states that they will take to killing goats; while women or children

who happen to come in their way at night also become victims. On the other hand, when far away from human habitations, such decrepit lions are stated by the same writer to catch mice and other small Rodents, and will even at times eat grass, although this may be taken medicinally.

That such lions, which have become too feeble to prey upon game, would naturally develop into "man-eaters," if they were permitted to live, appears highly probable. Mr. Selous believes, however, that the absence of man-eating lions in those parts of Africa with which he is acquainted is due "to the superior boldness of the African natives over those of India, for even amongst the least martial tribes of South Africa, if two or three people are killed by a lion, the population of the surrounding country is roused, and, a party being formed, the lion is usually surrounded and stabbed to death with assegais; whilst, amongst such warlike tribes as the Matabele, if a lion only kills an ox, or even a goat, its fate is usually sealed, or, even if not killed, it gets such a scare that it is glad to quit the district. Such a thing as a man-eater, or even an habitual cattle-slayer, would never be tolerated for an instant."

According, however, to Mr. Drummond, whose shooting experiences were confined to Eastern South Africa, in the districts of Zululand, Tongaland, and Swaziland, man-eating lions are to be met with in some regions. And this writer relates how he became an accessory to the death of two such man-eaters, one of which had well-nigh depopulated a district, having killed between thirty and forty individuals; while the second, although dwelling in an uninhabited country full of game, had become notorious for its attacks upon the camps of the hunters. The former, indeed, appeared to be an animal in the full enjoyment of bodily strength, as it is said to have habitually leaped over the high fences which surround the Zulu villages.

With regard to the method in which lions kill and carry off the larger animals upon which they prey, it may be observed, in the first place, that there is some doubt whether death is effected by dislocating the neck of the victim, as is always done by tigers. Mr. Blanford states that in a cow killed by a lion in Abyssinia the vertebræ of the neck were not dislocated; and that he also saw a lioness hold a camel for several minutes without attempting to break its neck. Mr. Selous is of opinion that lions have not one universal way of killing their prey, but they vary it according to circumstances. Thus he relates how he has seen a horse, a young elephant, and two antelopes killed by a bite in the throat; while he has also known instances of horses and zebras being killed by a bite on the back of the neck behind the head. Buffaloes, he believes, are sometimes killed by a dislocation of the neck, which is effected by "the lion springing on to their shoulders, and then seizing their noses with one paw, giving the neck a sudden wrench."

It was formerly a prevalent notion that lions were in the habit of carrying off the carcasses of large animals, like oxen and buffaloes, by throwing them over their backs and walking bodily away with them. All recent observers are, however, agreed that this is by no means a correct statement, and that their invariable practice is to transport such carcasses by dragging them along the ground. Mr. Selous states that in this manner lions carry off not only the bodies of the larger animals,

like buffaloes, but also those of the smaller antelopes; and he adds that a South African lion would, in his opinion, be quite incapable of lifting a buffalo from the ground, much less of leaping over a fence with it, as the lion of North Africa has been alleged to do. In referring to an instance of this nature when a North African lion was reported to have leaped over the thorn fence which formed a protection to a camp, and, after seizing a full-grown ox, bounded back with its victim, Sir Samuel Baker writes as follows: "In the confusion of a night attack the scare is stupendous, and no person would be able to declare that he actually saw the lion jump the fence with the bullock in its grip. It might appear to do this, but the ox would struggle violently, and in this struggle it would most probably burst through the fence, and subsequently be dragged away by the lion. . . . It is quite a mistake to suppose that a lion can carry a full-grown ox; it will partially lift the fore-quarters, and drag the carcass along the ground."

It is stated that the usual pace of a lion when undisturbed is a walk, but even then, from the length of his stride, he gets over the ground quicker than appears to be the case. When going more rapidly, Mr. Selous says that he has never seen a lion bound, but that they come along at a clumsy gallop, somewhat after the manner of a dog, getting over the ground very quickly.

In regard to the ferocity or otherwise of the lion's disposition, very conflicting statements will be found in the writings of different observers. Thus, whereas Livingstone states that nothing would lead him to attribute to the lion either the ferocious or noble character ascribed to it by others, Sir Samuel Baker is disposed to take a rather opposite view, observing that, although he does not consider the lion to be either so formidable or so ferocious as the tiger, yet there is no reason for despising an animal which has been respected from the most remote antiquity.

All writers appear, however, to be agreed that, as a general rule (although there are exceptions), a lion will not go out of his way to make an unprovoked attack upon human beings, and that, in point of fact, he will rather shun a conflict when possible. "There is nearly always," writes Mr. Drummond, "some explanation of its behavior when it acts otherwise: either the hunter has approached so near before being discovered that the animal is afraid to turn tail, and, urged by its very fears, makes a charge; or it may be half famished, and having got hold of some prey, either of your killing or its own, will not quit it without a contest; or, if a lioness with cubs, will fight in defense of their supposed danger." Sir Samuel Baker's testimony is of a very similar character, when he mentions that the expert swordmen of Central Africa have no dread of the lion when undisturbed by sportsmen, although they hold him in the highest respect when he becomes the object of chase. Again, in another passage, the same writer mentions that among the Hamran Arabs of the Sudan the lions although numerous, are never regarded as dangerous.

That lions, especially when hungry, will, however, on occasion attack human beings,—on foot or when mounted,—there is abundant evidence. Livingstone relates the well-known instance of a hunter engaged in stalking a rhinoceros, when, on looking back, he was horrified to find that he himself was being stalked by a lion. Mr. Drummond also records an instance where a lion, driven by hunger,

attacked him personally ; and he believes that there are some lions which will always make unprovoked attacks. This view he supports by an account of an attack made upon three natives in Eastern Africa. The three natives in question were passing along the edge of a certain lagoon, "when, without further warning than a slight rustle, a lion sprang upon the foremost, crushing him to the ground. His terrified comrades, throwing away the chance of shooting the brute while it was still upon its first victim and its eyes probably closed, rushed to the nearest trees for safety, but, once there, feeling ashamed of their cowardly desertion of an old companion, they descended, and walking forward together were just on the point of firing, when, with a roar that almost deprived them of the power to run, the lion charged, caught the hindmost, and after shaking him for a second or two gave chase to the other, who, however, had profited by the time to remove himself, by a bare foot or so, out of reach of the spring the enraged animal gave as it saw that one had so far escaped. It then returned to its last victim, not yet dead, took him up in its mouth, dropped him, tossed him from paw to paw as a cat does a mouse, and at last, as if wearied by so much unaccustomed gentleness, it allowed its savage nature to gain the mastery, and with one crunch of its powerful jaw put him out of his pain." The sole survivor of this tragedy, after having been besieged for hours in a tree, during which he had a hairbreadth escape when descending to reach his gun, finally had the satisfaction of putting a bullet through the ribs of the lion.

With regard to the dangers of lion hunting in Africa, which is mostly conducted on foot, those who have had the most experience, and are therefore the best entitled to speak with authority, are in accord as to their reality. Gordon Cumming says that lion hunting, under any circumstances, must of necessity be a dangerous pursuit ; but that it may be followed to a certain extent with comparative immunity from harm by those who have the necessary nerve, and coolness, coupled with sufficient knowledge of the habits of the animals. Mr. Selous, writing in 1881, when sixteen lions had fallen to his rifle, considers the lion a far more dangerous animal to encounter than any other creature in South Africa. It is true, indeed, that a much greater number of casualties occur from buffalo shooting than in lion hunting, but then as Mr. Selous is careful to observe, for every lion that has of late years been "bagged" in the interior of South Africa, at least fifty buffaloes have been laid low. As a general rule, according to the same authority, the danger is reduced to a minimum when hunting with dogs, as the lion's attention is generally concentrated on his canine foes ; but even then it sometimes happens that he will dash straight through them to attack the hunter. A mounted hunter, except when the movements of his horse are impeded by thick forest or by yielding sand, can generally escape when pursued, as, in the opinion of Mr. Selous, the pace of the average lion is not sufficient to enable him to overtake the average horse. "If, however, on foot," adds Mr. Selous, "and without dogs, though there is little danger in attacking lions in the first instance, yet to follow up a wounded one is very ticklish work, especially in long grass, or thick cover, for there is probably no animal of its size in the world that can conceal itself behind so slight a screen, or rush upon its pursuer with such lightning-like rapidity."

Stil more impressive are the words of Mr. Drummond, who says that "it should always be recollected, before meddling with lions, that if you do come to close quarters with them, death is the probable result. There are cases within my own knowledge," continues this writer, "where, single-handed and armed only with a spear, a native has succeeded in killing one that has sprung upon him, without receiving in return anything but trifling injuries; but these are only exceptions that prove the rule that when they strike they kill. . . . It is a grand sight to see one charge a native regiment sent out after it, as they sometimes are, springing over the heads of the first line right into the centre, flying about, knocking men down with every blow, until, a complete sieve of assegai wounds, it dies fighting."

Sir Samuel Baker follows suit in contrasting the dangers of the solitary hunter on foot engaged in lion shooting in Africa, with tiger shooting in India, either from elephants, or with a number of guns posted in secure positions.

Writing of his experiences in Somaliland, Mr. J. D. Inverarity observes that the lion tries to avoid man until wounded, and it is only in exceptional cases of there being young ones to guard, or from astonishment at seeing the hunter so close to them, that they charge when being tracked. They charge with the same coughing roar that a tiger does, and come at great speed close to the ground, not bounding in the air as they are represented in pictures. Their ears are pressed close to the head, giving them the comical appearance of being without ears. "So large an animal coming at full speed against you of course knocks you off you legs. The claws and teeth entering the flesh do not hurt so much as you would think. The only really painful part of the business is the squeeze given by the jaws on the bone. I felt none of the dreamy stupor Livingstone describes, but, on the contrary, felt as usual. I adopted the course of lying quite still, which, I believe, is the best thing one can do, as you are quite helpless with a heavy animal on you, and they are inclined to make grabs at everything that moves, and the fewer bites you can get off with the better." Stories of lion hunting are legion, and if collected would form at least one goodly volume; we shall, however, refrain from quoting any, and close our notice of what is, in our own opinion, the grandest of all Carnivores, with the following extract from Mr. Drummond's interesting book, upon which we have already drawn so largely. "Perhaps the most beautiful sight that I ever saw in connection with lions," writes Mr. Drummond, "was on a morning when I had gone out to hunt with one bearer at dawn. I had gone far from camp, and, most carelessly, my gun was still unloaded, while I was examining some buffalo spoors, when, on looking up, I saw my gun bearer, who had my cartridges, running away at full speed. Knowing that he must have seen something to frighten him so, I did not shout, but went to where he had been standing a few yards ahead, and there, sure enough, not twenty yards off, were a pair of lions. They were both full grown, and the male had an immense mane, and formed altogether as handsome a pair as I ever saw. The lioness was rolling on her back, playfully striking at her lord and master with her fore-paws just like a kitten, while he stood gravely and majestically looking on."



TIGER.

THE TIGER (*Felis tigris*)

Whether the lion or the tiger is the more powerful animal, is a question which has given rise to much discussion, but, as we have already mentioned, the opinion of one most competent to decide is in favor of the superiority in this respect of the latter. The absence of the mane, which forms such a striking feature in the male lion, renders, however, the appearance of the tiger decidedly less imposing, and hence the second position in the series is commonly assigned to this "cat."

In spite of the difference in coloration, the lion and the tiger are very closely-allied animals, both agreeing in having a circular aperture for the pupil of the eye, and also in regard to the characteristics of the so-called hyoid bones which support the tongue.



THE TIGER AND THE TIGRESS.

Next to the absence of the mane in the male, and likewise of any tuft at the extremity of the tail, the most important external difference between the lion and the tiger is that of color. The general ground color of the fur of the tiger is a rufous fawn on the upper part and sides of the body, but the tint may vary in different individuals from pale rufous to brownish yellow, the under parts of the body being white. This rufous ground color is striped transversely with black throughout the head, body, and limbs, while the tail is ringed with black. The ears are black, with the exception of a large white spot. These striking colors, which are fully developed at birth, are brightest in young and vigorous animals, gradually fading in intensity with advancing age; and it is stated that tigers inhabiting forest districts are the reddest in ground color. As rare exceptions, both white and black tigers are occasionally met with. Thus a white tiger, in which the fur was of a creamy

tint, with the usual stripes faintly visible in certain parts, was exhibited at the old menagerie at Exeter Change about the year 1820. A second example of a white tiger was recently obtained at Puna, India, by Major D. Robinson, of the Lancashire Fusiliers, and it appears to have been a male in the prime of life; while Colonel H. H. Godwin-Austen states that he has known of a third specimen. A perfectly black tiger, according to Mr. C. T. Buckland, was found dead many years ago near Chittagong, on the northeast frontier of India.

With the exception of a ruff of longish hair round the neck and throat of old males, which represents the mane of the male lion, the hair on the head and body of the Indian tiger is generally short and thick, but it is considerably more elongated and shaggy in Siberian examples. There is, moreover, a certain amount of variation in the length of the hair of the Indian tiger according to the season of the year.

The tail of the tiger, in both sexes, tapers regularly from root to tip; its total length being about half that of the combined length of the head and body.

When describing the lion, it has been mentioned how the skull of that animal can be distinguished at a glance from that of a tiger. And it may be added that a tiger's skull, according to Mr. Blanford, is, on the average, even wider and more massive than that of the lion. Moreover, in correlation with the more curved profile of the head of a tiger, as compared with that of a lion, the skull has its outline more convex, while the inferior border of the lower jaw is also straighter.

The tiger stands lower on the limbs than the lion, and is thus proportionately longer in the body. In regard to the size attained by tigers there has been even more exaggeration than in the case of the lion; this being in great part due to the measurements having been taken either from the skins after they had been removed from the animal and pegged out on the ground to dry, or from tigers which had been carried for several hours thrown across the backs of elephants, and thus considerably stretched beyond their normal length. Mr. Blanford states that full-grown male tigers measure from $5\frac{1}{2}$ to $6\frac{1}{2}$ feet from the tip of the nose to the root of the tail; the length of the tail being about 3 feet. In one example, whose total length was 9 feet 6 inches, the length of the head and body was 6 feet 4 inches, and that of the tail 3 feet 2 inches. Female tigers are generally about a foot shorter in the length of the head and body than males. The height of a tiger at the shoulder varies from about 3 feet to 3 feet 6 inches.

The above dimensions are taken in a straight line, but the usual manner of measuring a tiger adopted by sportsmen is to follow the curves of the body, when the dimensions will, of course, be somewhat greater; and it appears that all the largest tigers on record have been measured in this manner. Full-grown tigers thus measured vary from 9 to 10 feet in length; and tigresses from 8 to 9 feet. Unusually fine specimens will, however, reach or even slightly exceed, a length of 12 feet; 12 feet 2 inches being apparently the maximum dimensions ascertained with any approach to accuracy. It is, however, by no means invariably the case that tigresses reach the minimum length mentioned above, Mr. Blanford stating that he killed one apparently adult example that was only $7\frac{1}{2}$ feet long, while a second measured but 7 feet 8 inches.

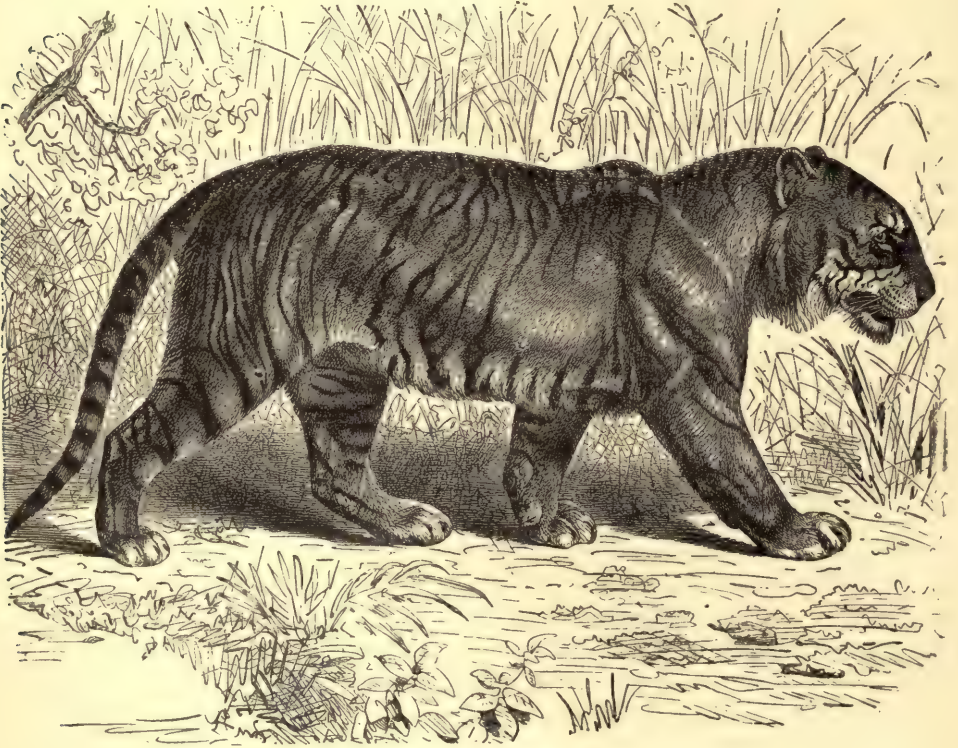
There is still need of additional information as to the maximum weight attained by tigers. Sanderson gave the weight of a fine male tiger killed by himself as 350 pounds; while specimens weighed by the late Sir W. Elliot weighed 362 and 380 pounds. Forsyth concluded, however, that some unusually large tigers, which fell to his own rifle, must have weighed from 450 to 500 pounds. These extreme weights have of late years, been confirmed by Mr. W. T. Hornaday, who records a tiger measuring 9 feet 11½ inches in length, of which the weight was upwards of 495 pounds. The Maharaja of Kuch-Behar has killed tigers which are stated to have varied from 481 to 540 pounds; and one shot by Mr. F. Shillingford, of which the length was 9 feet 10 inches, weighed a little over 520 pounds. The weight of a tiger depends, of course, largely upon the condition of the animal at the time of its death; and if a specimen under 10 feet in length will turn the scale at over 500 pounds, it may be taken as certain that those of 11 or 12 feet in equally good condition must reach considerably heavier weights.

Although mainly, if not entirely, confined to Asia, the tiger has an extensive geographical distribution on that continent and its islands. To the westward its range appears to be limited by the mountains of Ararat and the Caucasus, whence it extends along the southern shores of the Caspian—the ancient Hyrcania—into Northern Persia, the Herat district, and thence into Turkestan. Thence it ranges over a large portion of Central Asia, embracing Southern Siberia, to a line some distance north of Irkutsk, and the whole of Mongolia as far eastward as Amurland and the island of Saghalien. And its fossil remains have been obtained, in company with those of the mammoth, from the New Siberian islands lying some distance within the Arctic Circle. From Mongolia the range of the tiger extends southward through China to Burma, Siam, and the Malay Peninsula; and it also embraces the islands of Sumatra and Java, but not, it is said, Borneo. Across the Assam district, at the northern end of the Bay of Bengal, the tiger ranges into India, where it is found from Cape Comorin to the Himalayas; although quite unknown in the island of Ceylon. The whole of the elevated plateau of Tibet forms, however, an island in its distributional area into which the tiger does not intrude. And, as we learn from Mr. Blandford, it is equally unknown in Afghanistan and Baluchistan, as well as in that portion of Persia lying to the southward of the Elburz mountains. From this extensive distribution it is evident that the popular idea of regarding the tiger as a tropical animal is quite erroneous. And it is even doubtful—in spite of the world-wide reputation of the Bengal tiger—whether those inhabiting the warmer regions are its most magnificent examples. In spite of this, the tiger is so intimately associated with and characteristic of India, that it will always—and rightly—be regarded as the special emblem of that country. Mr. Blandford believes that the absence of the tiger from Ceylon may be taken as an indication that the animal is a comparatively recent immigrant into Southern India, since most of the other Indian Mammals are found on both sides of the straits of Palk.

Although in some of the more thickly populated districts of India especially those well supplied with railroads, such as parts of Bengal, the Central Provinces, and Bombay, tigers have greatly decreased in numbers, or have well-nigh or com-

pletely disappeared, in the wilder and more sparsely inhabited districts they are often still abundant. Indeed, wherever large tracts of forest and grass jungle remain in India, there tigers are to be found in more or less abundance.

In the fever-stricken swamps and islands forming the so-called sandarbans of Lower Bengal, tigers are especially common; as they also are in the forests of Burma and Assam. Formerly, Sir Samuel Baker tells us, they were to be met with in the grassy islands of the Bramaputra, but the navigation of that river by steamers has led to a large reduction in their numbers. In the forests flanking the easterly Himalayas, and known as the Terai, tigers still abound; and they will at



THE BENGAL TIGER.
(One-twelfth natural size.)

times ascend in the mountains to heights of six thousand or seven thousand feet above the sea level, although they are unknown in the interior of the Himalayas. In some parts of India it was necessary to take active measures against them, in order to prevent the annihilation of the population. Thus a recent writer states that in Manipur "tigers used to be so numerous that the inhabitants were formed into groups for the purpose of marking them down and destroying them. This organization still exists. The groups are called *kai-roop*, and it is the duty of the chief of the *kai-roop* of the district to report to the raja whenever a tiger appears within his jurisdiction; the order is then given to destroy him; this is done by sur-

rounding the patch of jungle in which he has hidden, after killing a cow or deer, with strong nets. Outside these, tall bamboo palisading is erected, and information is sent to the raja, who, if the place is within easy distance, proceeds there with all his court, ladies included. The spectators are ranged on seats at intervals at the top of the palisading, and the tiger is driven by firebrands from his retreat, and either shot or speared. The Manipuris are very keen at this sport, and I have seen them, despite a prohibition to the contrary, descend into the arena (perhaps a space of three hundreds yards, or even more, in circumference) and, protected only by the net held up by a forked stick in the left hand, boldly attack the tiger with a spear. Generally, the real sport is shown with the spear, and the *coup de grâce* given by a rifle shot. Anyhow, the men engaged display great courage and coolness, and the whole affair is not a vulgar piece of butchery but a game of skill, till a well-directed shot ends it." Toward the western end of the Himalayas, where forests become much thinner and the whole country is much drier, tigers gradually become less common; and in the Western Punjab and Sind they are either very rare or quite unknown.

In parts of Java and Sumatra tigers absolutely swarm; and a firm of Dutch merchants at Padang, Sumatra, writing in the autumn of 1891, stated that the arrivals of coffee from the interior were much below the usual average, on account of the number of tigers infesting the route; upwards of fifty men having been killed by them while engaged in bringing the coffee down country.

Writing of the distribution of these animals in Persia, the late Sir O. B. St. John states that tigers, twenty years ago, were very numerous in the Caspian provinces of Persia, and in the Caucasus as far as the mouth of the Araxes. The dense vegetation, which although of a temperate character, yet attained a tropical luxuriance, affording them shelter as perfect as that of the jungles of the Terai, or the swamps of the sandarbans of Bengal.

Although when the animal is seen within the narrow limits of the cage of a menagerie, or stuffed in the case of a museum, the brilliant coloration of the tiger may appear conspicuous in the extreme, yet there is little doubt that in the native haunts of the animal it is essentially of a protective nature. Sir J. Fayrer, in his work, *The Royal Tiger of Bengal*, observes, that brilliant as is the general color of the tiger, "it is remarkable how well it harmonizes with the grass bush among which he prowls, and for which, indeed, until his charge, and the short deep growls or barkings which accompany it, reveal his presence, he may be mistaken." Indeed, the vertical stripes of tawny orange and black on the skin of the tiger harmonize so exactly with the broad blades of yellow grass, separated by equally broad lines of blackest shade, that it is often difficult indeed to distinguish the animal from his surroundings when seen in his native jungle during an Indian summer. And, in this connection, it is noteworthy that the tigers of Northern Asia, where dry grass jungles like those of India are unknown, are stated to have the ground color of their skins of a much less brilliant hue.

The literature relating to the habits and mode of life of the tiger is even more extensive than is the case with the lion; while that devoted to tiger shooting is simply appalling in quantity. While the terms noble and majestic are those which

were formerly, and often still applied to the lion, the epithets cunning and cruel are more generally assigned to the tiger; while the word "tigerish" has become an integral portion of our language to denote ferocious cruelty. It may be doubted, however, whether these epithets are really more exclusively applicable to the one than to the other animal, when the different conditions under which they live are taken into account. It is true, indeed, that the amount of damage done by tigers is vastly greater than that which can be charged to lions; but then it must be remembered that, whereas the former frequently inhabit more or less densely-populated districts, the latter are often found in regions where there are but few human inhabitants, and but small numbers of cattle. Then again, the more warlike nature of many of the African races, as compared with those of India, is fatal to the existence of man-eating lions, whereas man-eating tigers in India are frequently regarded with superstitious reverence, and no attempts are made at their destruction.

Although there is a great difference in the habits of individual tigers, according to whether they live on wild game killed in the jungles, or on domestic cattle, or are man-eaters, yet the whole of them have certain characteristics in common. Thus, as a rule, the Indian tiger is a solitary and unsociable animal, although at certain seasons of the year the pairs of males and females associate more or less closely together. In all cases the male consorts with but a single female; but it has not yet been definitely ascertained whether this union is permanent. Occasionally, however, as many as four, five, or even six, full-grown tigers have been seen in company; and it appears that these are always family parties, the cubs having remained with their parents till grown up. Like the lion, the tiger is essentially nocturnal, lying concealed in the long grass or forests till evening, and then issuing forth for its nightly prowls. Their wanderings during the cold and wet seasons at least are considerable, and it is considered by Sir J. Fayrer that at such periods of the year they have no fixed abodes. During the hot season, however, when the whole country is burnt up with the heat, and the smaller streams, pools, and tanks are dry, the range of the Indian tiger* becomes much more restricted. At such times it takes up one definite "beat," haunting the banks of the rivers, and patches of long grass which are kept fresh and green by growing near water, or in swampy ground. And it is remarkable, as Sir Samuel Baker observes, that when a tiger with a restricted beat is killed, in the course of a few months another will occupy its place, frequenting the same lairs, and drinking at the same pools. Grass jungles and swamps are, however, by no means the sole haunts of the tiger, which will frequent any kind of country that will afford the necessary shelter and a plentiful supply of water. In addition to forests, tigers select as their lurking places, clefts and caves in rocks, the shelter afforded by a high bank, or the grass-grown ruins of the numerous deserted cities to be found in many parts of the plains of India. And it is curious to observe that in many cases one particular rock, or one patch of grass, is always inhabited by a tiger, while another, apparently equally suitable, has no

*As almost the whole of our knowledge of the habits of tigers is derived from India, our remarks apply in great measure only to those of that country.

such tenant. Moreover, in the plains of India, wherever tigers are met with, there will wild peafowl invariably be found.

Tigers are extremely impatient of the fierce heat of the dry season, and always try to shelter themselves as much as possible from the burning rays of the sun. This impatience of extreme heat, taken in conjunction with their occurrence in comparatively cool climates, like those of Northern China, Manchuria, and parts of Siberia, where the winters are severe, is in favor of the view of Mr. Blanford, already mentioned, that these animals are comparatively recent immigrants into a large portion of India. To aid in mitigating the heat of the dry season, tigers are in the habit of wallowing in the shallow water of swamps and the margins of rivers, and then rolling in the dry sand after their mud bath. Such, at any rate, are their habits in the plains of Bengal, Assam, etc.; but it has been stated that on the Nilgiri hills in Southern India, tigers are never known to wallow in this manner. Not only does the tiger indulge in such wallowings during the hot season, but he is also an excellent swimmer, and will take readily to the water. In the Bramaputra, where reedy and grassy islands and sand banks, locally known as *churs*, intercept the course of the river, tigers, as Sir Samuel Baker tells us, swim for miles during the night from island to island in search of prey and if unsuccessful return at dawn to the mainland. They likewise display very similar habits in the Bengal sandarbans, where they not unfrequently cross small arms of the sea. Sometimes they are compelled to take involuntarily to the water, as in the case of the great inundations in the valleys of the larger Indian rivers, or when tidal waves overflow the low-lying lands bordering the Bay of Bengal. On such occasions the unfortunate animals are often put to sore straits to find a refuge from the waste of waters, and Sir Samuel Baker relates an instance of a tiger, during an inundation on the Bramaputra, having climbed up during the night on the high rudder of a vessel, much to the astonishment and alarm of the native steersman, when he beheld his visitor in the morning. From this position the tiger made his way to the deck of the steamer towing the barge, where he was eventually killed in the paddle box.

In spite of its predilection for water, the tiger can, however, at a pinch endure thirst for a considerable period, even in the hottest weather. As an instance of this we may refer to an account given by Mr. G. P. Sanderson, where two tigers were surrounded by nets in a small patch of jungle. "The weather," writes the narrator, "was hot; the circle in which they were enclosed was only seventy yards in diameter, and the heat of the fires kept up day and night all round was considerable. Still they existed without a drop of water for ten days, suffering from wounds half the time. A tiger can go much longer than this without food without serious inconvenience." Like lions, tigers are bad climbers, ascending trees but rarely, and, according to Mr. Blanford, being quite incapable of ascending a vertical stem, no matter what may be its dimensions. But, when aided by a sloping stem, or by a fork at some distance from the ground into which they can spring and thence obtain a fresh start, tigers will occasionally attack sportsmen who are waiting for them in trees. It is also stated that, when caught by inundations, tigers will endeavor to escape by climbing. Stems of trees, especially certain particular favorites, are in tiger-haunted districts marked by the vertical scorings in the bark

made by the claws of tigers; these markings not unfrequently extending to a height of at least ten feet.

The idea that tigers are in the general habit of springing appears to be a popular delusion; and, according to Mr. Blanford, it is but rarely that they move their hind-legs from the ground, except when they have occasion to clear a fence or other obstacle. When so inclined, they are undoubtedly able to spring to a considerable height; and an instance is on record of a tiger having, at a single spring, pulled a native from a tree, at a distance of eighteen feet from the ground. Mr. Sanderson gives fifteen feet as the maximum horizontal distance that a tiger can spring. "The tiger's usual attack," writes Sir J. Fayer, "is a rush, accompanied by a series of short deep growls or roars, in which he evidently thinks he will do much by intimidation; when he charges home he rises on the hind-feet, seizes with the teeth and claws, and endeavors and often succeeds in pulling down the object seized." The mention of the tiger's attack reminds us that, according to Sir Samuel Baker, it is but comparatively rare that one of these animals, when suddenly and unexpectedly disturbed, will fly at a human being. "The truth is that the tiger seldom attacks to actually kill, unless it is driven, or wounded in a hunt. It will frequently charge with a short roar if suddenly disturbed, but it does not intend to charge home, and a shout from a native will be sufficient to turn it aside; it will then dash forward and disappear, probably as glad to lose sight of the man as he is at his escape from danger."

In many of the foregoing traits of character the tiger resembles more or less closely the lion; but whereas the latter is an extremely noisy animal, the former roars much less frequently. Mr. Blanford, who has especially called attention to this difference in the habits of the two animals, observes that, where lions "are common, scarcely an evening passes without their being repeatedly heard. I have often been in places where tigers were equally abundant, but it is the exception for their roaring to attract attention. Their usual call is very similar to that of the lion—a prolonged, moaning, thrilling sound, repeated twice or thrice, becoming louder and quicker, and ending with three or four repetitions of the last portion of it. Besides this, there is a peculiar loud 'woof' produced when the animal is disturbed or surprised, a growl that it utters when provoked, and the well-known guttural sound of rage repeated two or three times when it charges. When hit by a bullet a tiger generally roars, but tigresses, at all events, very often do not; I have on three occasions, at least, known a tigress receive a mortal wound and pass on without making a sound."

With regard to the breeding of tigers, it appears that the number of cubs produced at a birth usually varies from two to five, although it is said that there are occasional instances where the litter includes as many as six. As the result of his long experience, Mr. Sanderson gives two as the usual number, three being much rarer, and only two instances of four in a litter having come under his personal observation. Mr. Blanford states, however, that he has on more than one occasion seen four cubs. When there are but two, it appears that while one is a male the other is a female; and this general equality in the sexes of a litter renders it difficult, as Mr. Sanderson remarks, to account for the large preponderance of adult

tigresses over tigers. Tigresses appear to breed at all times of the year; young cubs having been taken by Mr. Sanderson in the months of March, May, and October. Tiger cubs, which require a period of about three years to attain maturity, remain with the tigers for the greater part of that time; and, as already mentioned, when several adult tigers are found together, the party is a family one. Mr. Sanderson is of opinion that the tigress does not breed oftener than once in two years; while from the circumstance that the cubs do not attain maturity till that period, Forsyth considered that once in three years was the minimum. In captivity tigers breed much less freely than lions, and the cubs are far more difficult to rear. Although when caught young tigers can be easily tamed, they are more intractable than lions when taken at a later age.

The food of individual tigers varies greatly, according as they frequent uninhabited or populous districts. The typical jungle tiger lives chiefly upon the various species of deer, wild pigs, and antelopes; but it will kill domestic cattle, and will also eat porcupines, monkeys, peafowl, and other small animals. Although full-grown buffalo and gaur are usually a match for it, young or feeble individuals not unfrequently fall victims to its attack; and instances are recorded of young elephants being killed and eaten. Adult bull gaur are, however, occasionally killed by tigers; the latter, according to the report of native herdsmen, inducing the bulls to charge time after time, when they are wounded as they pass by a blow on the flanks from the tiger's paw. Old wild boars will, it is said, not unfrequently succeed in wounding and beating off a tiger; and the herds of buffaloes defend themselves by forming in a half circle, with the bulls facing the foe. Moreover, even when a calf, or a weak or sickly adult individual has been carried off, the old buffaloes are reported to combine and follow the tiger and rescue the victim from his clutches. Much more rarely tigers will kill and eat the Indian bear; and Mr. Sanderson relates an instance of a tiger having habitually taken to killing and eating those animals. That the male tiger will sometimes devour his own offspring is well authenticated; and Mr. Sanderson was informed, on what he considers good authority, of an instance where three tigers devoured another individual of their own species.

The "kill" of the tiger is frequently kept until, in the hot climate of India, it assumes a putrid condition; and, in addition to carrion of this nature, there is good evidence that tigers will eat the decomposing flesh of animals other than those killed by themselves. The tigers dwelling near villages are, unless they are man-eaters, in the habit of living more or less entirely on the small native cattle, which are generally, and especially in the dry season, in miserable condition. In Central Asia, where, according to Eversmann, the tiger is abundant in the reed thickets on the east bank of the Sea of Aral and the Sir Darya, as well as in the Kirghiz steppes, its chief food is derived from the wild swine which inhabit those thickets, and also from the herds of wild asses and saiga antelope frequenting the more open country. In these districts the tiger is much dreaded by the nomadic inhabitants; and it is said to attain dimensions considerably greater than those which it reaches in warmer regions.

Much misapprehension has prevailed as to the mode in which tigers kill their prey; the ordinary notion that they spring upon their victims from a distance, and

after killing them either by a blow from the paw, or by tearing at the throat with their claws, and afterwards sucking the blood, being now proved to be incorrect. Mr. Sanderson, who has paid particular attention to these points, and whose explanation, although at variance with that of some other experienced sportsmen, is now pretty generally accepted, writes as follows on the subject: "I have never witnessed a tiger actually seize its prey, but it has been described to me by men who have seen the occurrence scores of times within a few yards' distance while tending cattle. The general method is for the tiger to slink up under cover of bushes or long grass, ahead of the cattle in the direction they are feeding, and to make a rush at the first cow or bullock that comes within five or six yards. The tiger does not spring upon his prey in the manner usually represented. Clutching the bullock's fore-quarters with his paws, one being generally over the shoulder, he seizes the throat in his jaws from underneath, and turns it upwards and over, sometimes springing to the far side in doing so, to throw the bullock over, and give the wrench which dislocates its neck. This is frequently done so quickly that the tiger, if timid, is in retreat again almost before the herdsman can turn round. Bold animals often kill several head, unsophisticated cattle occasionally standing and staring at the tiger in stupid astonishment; but herds that are accustomed to these raids only enter the jungle with extreme unwillingness." Occasionally the tiger seizes its prey by the nape of the neck; the blow of his paw will, however, stun even a large animal; and it is quite possible that cattle may be killed in this manner. Tigers will on rare occasions kill buffalo and gaur, and similar prey, by hamstringing them, probably by a blow with the claws. Such hamstrung animals are occasionally met with, but the exact method in which it is accomplished remains unknown. The notion that the tiger sucks the blood of his victim is a myth. The late afternoon is the time at which cattle are usually seized by tigers when grazing in the jungles, although they may be struck down at any time of the day. If killed during the daytime the carcass of the victim is usually left where it lies till evening. At nightfall, or perhaps earlier, the tiger returns to the "kill," and either commences to devour it at once, if the spot is sufficiently secluded, or proceeds to remove it to one more convenient. The feast is commenced on the hind-quarters as a general rule; and, after he has satisfied his appetite, the tiger may either retire to a convenient resting place in the neighborhood, from which it can rush out to drive away jackals and other intruders from the "kill," or may completely conceal it under bushes and leaves, and seek a more distant lair in the neighborhood of water. When it has recovered from the effects of its gorge, the tiger returns for a second meal; and it appears that in about three days the carcass is reduced to little more than a skeleton. During the intervals between his meals, the tiger is sluggish and stupid, being with difficulty aroused from his slumbers, and when so awakened he is dull and indisposed to show fight.

Although it has been much exaggerated, the strength displayed by a tiger in carrying off his prey is enormous. The weight of the ordinary Indian cattle according to Sir Samuel Baker's estimate, may be set down roughly at from 350 to 400 pounds. And although it is quite an error to suppose that a tiger can take a carcass of that weight and carry it in his mouth without letting any portion of it

drag on the ground, at least at intervals, yet it is quite certain that he can carry it. Thus, Mr. Sanderson relates how a powerful tiger had taken up and carried the carcass of a bullock through a dense thicket for about three hundred yards; while a smaller tigress carried one in open jungle for a shorter distance. As a general rule, however, the bodies are dragged along the ground; although this, when the nature of the surface in Indian jungles is taken into account, is a sufficiently formidable task.

Forsyth considered it probable that a cattle-killing tiger destroyed a victim about every fifth day; three days being employed in feasting on the carcass and resting in the intervals, while during the other two food was not specially sought. This, when we remember the number of these animals in certain parts of India, will give some idea of the losses they occasion. According to a return issued by the Government, it appears that in the Madras Presidency, during the quarter ending December 31st, 1891, the number of animals killed by tigers and leopards included 656 bullocks, 752 cows, 236 calves, 135 buffaloes, 105 sheep, and 103 goats. In the returns for all India for one year, during which 1,835 cattle were killed, the total loss was set down at a little short of 60,000 head, of which 20,000 were assigned to tigers, and an equal number to leopards. Although the man-eating tiger is much more dreaded, the cattle-lifting tiger is regarded with supreme indifference by the herdsmen of the districts it infests. "It is no uncommon feat," observes a well-known popular writer, "for a party of jungle herdsmen armed only with their iron-bound *lathis*, or quarterstaves, to boldly show fight to the royal robber, and by sheer pluck and gallant daring beat him off from some member of their herd that he may have attacked. Too frequently, to be sure, some one or more of the number may pay dearly for their temerity, but it is an apt illustration of the fact that men get inured to a commonly-incurred danger." Mr. Blanford mentions that he once came across two children, of which the elder was not more than eight or nine years of age, who had actually been placed in the jungle as a guard over the dead body of a bullock, to protect it from the return visit of the tiger by which it had been slain.

It has been considered that man-eating tigers, which generally belong to the female sex, were invariably animals unable to procure other food, from the effects of age. Although this is true in a very large number of instances, it appears that tigers may take to man-eating from a variety of other causes. Thus either wounds, excessive fat, or the fact of a tigress having had to bring up a family of cubs where food is scarce, may be the original cause of the adoption of this mode of life. According to Mr. Sanderson, all man-eaters were invariably at first cattle stealers, which gradually became accustomed to the sight and presence of man, and thus lost their instinctive fear of the human race. When once a tiger has taken to man-eating, and has discovered how easily its victims are killed, it appears that it ever afterwards hunts the same kind of prey, although only some individuals confine themselves to this kind of food. Those tigers which are entirely or mainly man-eaters inflict fearful havoc on the unfortunate natives among whom they have taken up their quarters; an average native of India, as Sir Samuel Baker remarks, forming by no means a hearty meal for a tiger.

All who have had to do with them are unanimous as to the extreme wariness and caution of man-eaters, which from this cause are the most difficult to kill of all tigers. The slightest rustle or whisper on the part of the pursuer is, according to Mr. Sanderson, sufficient to put the man-eater on its guard; and it is marvelous with what sagacity these animals distinguish between an armed sportsman and a helpless unarmed native. "The man-eater," says Sir Samuel Baker, "will seize an unsuspecting native by the neck, and will then drag the body to some retreat in which it can devour its prey in undisturbed security. Having consumed the hind-



THE STRUGGLE IN THE STREAM.

quarters, thighs, and more fleshy portions it will probably leave the body, and will never return again to the carcass, but will seek a fresh victim, perhaps at some miles' distance, in the neighborhood of another village."

Formerly, before European sportsmen armed with rifles had access to most parts of the country by means of railways, whole districts in India were either depopulated or deserted owing to the ravages of man-eaters; and the sites of hamlets abandoned from this cause are still visible in the jungles. Not unfrequently, however, the cunning and caution of the man-eater baffles, at least for a time, all

the efforts of the European sportsman to encompass its destruction ; while there are districts where one of these pests may continue its depredations for a long period without coming under the notice of Europeans. The destruction of human life by tigers, most of which are probably habitual man-eaters, is, indeed, still deplorably large, especially in the more thinly-populated districts. According to the Government returns, it appears that within a period of six years no less than 4,218 natives fell victims to tigers, while in the Central Provinces alone 285 were killed during the years 1868 and 1869. In regard to the ravages committed by individual man-eaters, a gentleman, writing from Nayadunka to Sir J. Fayrer, states that "one tiger in 1867, 1868, 1869, killed respectively twenty-seven, thirty-four, and forty-seven people. I have known it to attack a party, and kill four or five at a time. Once it killed a father, mother, and three children ; and the week before it was shot it killed seven people. It wandered over a tract of twenty miles, never remaining in the same spot two consecutive days, and was at last killed by a bullet from a spring gun when returning to feed on the body of one of its victims." It will be observed that the concluding sentence of this account does not bear out Sir Samuel Baker's statement that the man-eater never revisits its "kill." The account of the depredations of another man-eater, which infested the neighborhood of the station of Naini-Tal in the Eastern Himalayas, states that the animal "prowled about within a circle, say of twenty miles, and that it killed on an average about eighty men per annum."

In order to rid themselves of these pests, the natives of India and other countries have had recourse to all kinds of traps and other devices. Among these, pitfalls used to be a favorite method. According to Mr. Wallace, in Sumatra, these pits are made in the form of an iron furnace, wider at the bottom than at the top, and from about fifteen to twenty feet in depth ; a sharpened stake being fixed at the bottom. The top of the pit is then covered over with branches and leaves, and so perfect is the concealment, that Mr. Wallace states that he has more than once had a narrow escape from falling into these pits. Indeed, one unfortunate traveler was killed by a fall on to the sharpened stake, after which that portion of the contrivance was forbidden. Large mouse-trap cages for catching tigers alive were formerly sometimes used in certain parts of India ; but Mr. Blanford states that these were more successful in catching leopards than tigers. Poisoning the "kill" of a tiger is also a method that has been more or less successful ; while bows with poisoned arrows and spring guns set in the tiger's path have also been called into requisition. In certain parts of the Mysore district Mr. Sanderson states that the villagers are in the habit of surrounding tigers with nets, and then spearing or shooting them ; this, except watching, being the only means by which they can be killed in covert which is too dense to admit of driving. In Orissa, on the upper part of the Eastern Coast of India, and perhaps elsewhere, the natives, according to Mr. Blanford, construct a gigantic figure-4 trap loaded with a platform of heavy stones, that falls upon and crushes the tiger, after the manner of the brick or tile trap used by gardeners in this country to kill field mice. In some of the older works relating to the tiger there will be found circumstantial accounts of a method of capturing the animal by smearing leaves with bird-lime which adheres to its face and paws, and thus

renders it completely blind and helpless ; but Sir J. Fayrer states that he is unaware of any authenticated instance where this method has been put in practice.

No account of the tiger would be complete without some reference to the modes of hunting or shooting adopted by Europeans and many of the native chiefs and shikaris, but as all these are fully described in works more especially devoted to sport, such reference will be of the briefest. One plan, especially favored by the native shikari, who is less impatient of a solitary night watch than most Europeans, is to build a platform or *machan* in a tree near the "kill," from which the tiger may be shot on his return visit, a variation of this plan being to construct the machan in any likely spot, and to tie up a goat, cow, or buffalo as a bait. The uncertain light prevailing at the time of the tiger's visit renders shooting from these machans far from certain. Throughout a large portion of Bengal, the Northwest Provinces, Central India, and the Terai-land at the foot of the Himalayas, where tigers are generally found in swamps and grass jungle—the grass in the latter being often from eight to ten feet in height,—the common, and indeed often the only practicable plan is to beat the jungles with lines of elephants; the sportsmen either shooting from their howdahs, or from machans placed in trees in positions commanding the ways along which the tiger is likely to bolt. In other districts, and more especially in parts of Bombay and Madras, tiger shooting is often undertaken on foot. And, as Sir J. Fayrer observes, it is in this dangerous sport that fatal and serious accidents are likely to happen, for no accuracy of aim or steadiness of nerve can always guard against or prevent the rush of even a mortally wounded tiger, that in its very death throes may inflict a dangerous or fatal injury.

Stories of hair-breadth escapes from tigers, both when shooting on foot and from the howdah, might be collected almost by the hundred, but would be foreign to our purpose. We may, however, mention that in many parts of India the tiger is regarded by the natives with a superstitious awe, which prevents them from killing it, even when they have the power. As might be expected, this awe is more developed among the superstitious Hindus than among the Mohammedans. In all cases, however, it appears that the natives have no objection to the slaughter of the tiger by Europeans. Frequently the tiger is regarded as tenanted by a spirit rendering it immortal; and in many districts the animal is never mentioned by its proper name, *sher* or *bagh*, but invariably by some euphemism. Closely connected with this superstition is the avidity with which the claws, whiskers, front teeth, and the imperfect collar bones of the tiger are collected and preserved as charms by the natives of many districts; although by others they are held as deadly poisons, and are destroyed as soon as possible. For these reasons a tiger skin with the whiskers preserved is a rarity.

THE LEOPARD (*Felis pardus*)

The third in point of size of the Old World cats is the leopard, or panther, a species closely allied to the lion and tiger, from whom it is at once distinguished by its coloration and inferior dimensions. In many works, written more from the



LEOPARDS.

sporting than the purely zoological point of view, it will be found that two species of large spotted cats are recognized as inhabiting Africa and India, to the smaller of which the name leopard is restricted, while the larger is known as the panther. Although there is an enormous amount of difference between the smallest and the largest of such spotted cats in point of size, yet, in the opinion of those who have paid most attention to the subject, the transition from the one to the other is so gradual and complete that, in a large series of specimens, it is quite impossible to say where leopards end and panthers begin. Hence it is concluded that there is but a single species, for which the name leopard should be adopted. The spotted coat of



THE LEOPARD.
(One-twelfth natural size.)

the leopard being its most distinctive feature, the animal (in common with the hunting-leopard) is known to the natives of India as the chita, meaning spotted; the leopard, on account of its larger size being often distinguished as the chita-bagh, or spotted tiger. By Europeans the name chita (or cheetah) has been very generally restricted to the hunting-leopard; but, as the above remarks show, there is no justification for this use, and it is accordingly preferable to call each of the two animals by its English title. The ground color of the fur of the leopard is subject to considerable individual variation, but it is generally of a yellowish fawn,

with a more or less marked rufous tinge, becoming gradually lighter on the flanks, and thus passing into pure white on the under parts. The spots, which are very variable in size and number, take the form of rosettes, and consist, on the upper parts, of an irregular black ring (nearly always incomplete), enclosing a bright central area, which may be of the same tint as the general ground color, but is not unfrequently darker. On the head, lower portions of the limbs, and flanks (where they are brownish), the spots have no light centres, and are smaller. The tail, of which the length may vary from rather more than one-half to about three-quarters that of the head and body, is likewise spotted throughout the greater part of its length; but at and near the tip the spots become larger and fewer, and tend to form more or less nearly complete rings. Leopard cubs do not have the color so well defined or so brilliant as in the adult animal. The hair on the head and body is generally short and close, but tends to become longer when the animal inhabits colder regions than usual, and that on the tail and under parts is always longer than the rest. From this normal coloration an almost complete transition can be observed to black leopards, which were at one time regarded as belonging to a distinct species. Perfectly black leopards have been only found hitherto in Asia, and appear to be more common in the hills of Southern India, and the Malay Peninsula and islands, than elsewhere. The skin of such black specimens, when viewed in certain lights, invariably exhibits a kind of "watered-silk" appearance, due to the presence of the spots, in which the hair has a still deeper tinge of black than elsewhere. That such black leopards are nothing more than varieties is proved by instances where a female of the ordinary color has given birth to a litter, among which was a black cub. One such instance is recorded by Mr. G. P. Sanderson as having taken place at the Zoological Gardens at Amsterdam, where a female gave birth to one spotted and one black cub.

Although no perfectly black leopards have ever been found in Africa, yet there occurs in the southern portion of that country a rare variety which exhibits a more or less strongly-marked tendency towards blackness. One such specimen was described in 1885 by Dr. Günther, which was obtained in hilly land covered with scrub jungle, near Grahamstown. The ground color of this animal was a rich tawny, with an orange tinge; but the spots, instead of being of the usual rosette-like form, were nearly all small and solid, like those on the head of an ordinary leopard; while from the top of the head to near the root of the tail the spots become almost confluent, producing the appearance of a broad streak of black running down the back. A second skin, figured by the same writer in the following year, had the black area embracing nearly the whole of the back and flanks, without showing any trace of the spots, while, in those portions of the skin where the latter remain, they were of the same form as in the first specimen. Two other specimens are known; the whole four having been obtained from the Albany district. It will thus be apparent that these dark-colored African leopards differ from the black leopards of Asia, in that while in the latter the rosette-like spots are always retained, and are always visible, in the former the rosettes are lost (as, indeed, is to a considerable extent often the case with ordinary African leopards), and all trace of spots disappears from the blacker portions of the skin. It is, however, noteworthy

that in both countries these leopards are found in hilly regions, more or less thickly covered with jungle, from which it would seem that such districts are in some way connected with the abnormal development of dark color. Far rarer than black leopards, are white ones, and but very few have been met with. In addition to these black and white varieties of the leopard, there are minor variations noticeable in the skins of specimens from different places. In the first place, as Mr. Blanford observes, African leopards always have smaller and more solid spots than



BLACK LEOPARD.
(One-twelfth natural size.)

the Indian animal, so that the skins of the two can be distinguished at a glance. Then there is a race of Persian leopards, also found in Baluchistan and Sind, in which the fur is longer, and the tail thicker than ordinary; while the coloration is intermediate between that of the ordinary leopard and the ounce. Further, according to the author just mentioned, the leopards from Peninsular India have less richly-colored skins than those inhabiting the damp forests of the Himalayas, Ben-

gal, Assam, and Burma; and the spots on them are as a rule much smaller. Two leopards, the one from China and the other from Persia, described by M. A. Milne-Edwards, were remarkable for the circumstance that the markings on the flanks were more like rings than rosettes, while the tail in each case was shorter than the body alone.

The differences in the size of individual leopards is so great that while in the smallest examples the total length of the head, body, and tail does not exceed 5 feet, in the largest it reaches to as much as 8 feet. In a large male, of which the total length was 7 feet 11 inches, the head and body measured 4 feet 9 inches, and the tail 3 feet 2 inches.

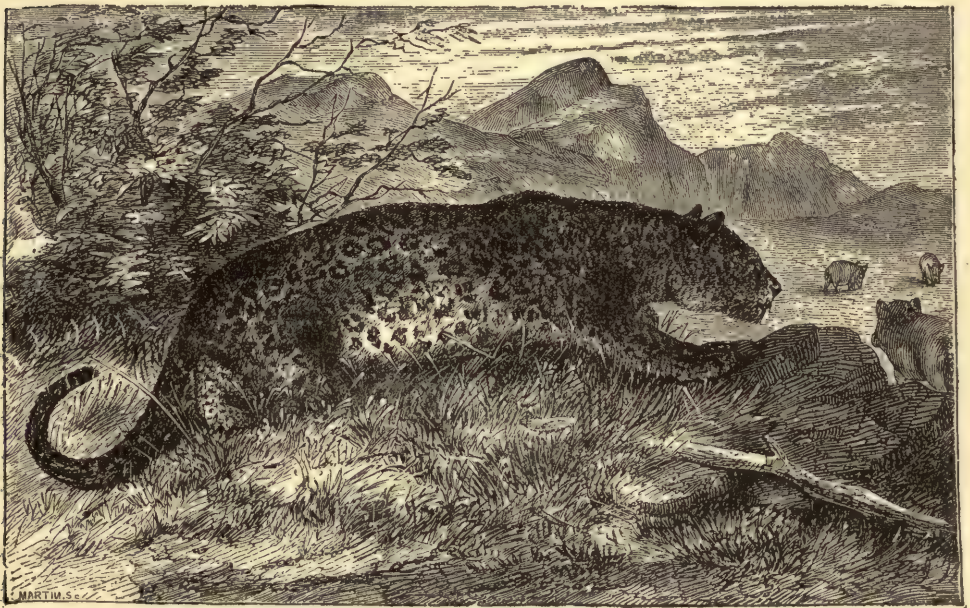
The leopard is one of the three larger cats which are common to India and Africa; the other two being the lion and the hunting-leopard. The distribution of the leopard is, however, more extensive than that of the lion, embracing nearly the whole of Asia, from Persia to Japan, but not extending as far north as Siberia; while the animal is unknown on the high plateau of Tibet, where almost all the Mammals belong to peculiar species not found elsewhere.

Leopards occur over almost the whole of India, although absent from parts of Sind and the Punjab; and they are abundant in Ceylon, Burma, and the islands of the Malayan region. Westward they extend into Persia, Palestine, Arabia, and Syria, and thence into Africa, where they range from Somaliland and Algeria to the Cape Colony. This is, however, not all, since the evidence of fossil bones found in the caverns and superficial deposits of Western Europe proves that the leopard (or, at all events, a large cat of which the bones and teeth are indistinguishable from those of a leopard) formerly ranged as far west as Great Britain, France, and Spain. Its distribution is and was considerably more extensive than that of the lion, which, as we have seen, never extended eastward of the Bay of Bengal; and it is larger than that of any other member of the Cat family except the lynx.

Next to the tiger in India and to the lion in Africa, the leopard is the most formidable Carnivore (exclusive in India of bears) to be found in either country. In its habits it differs essentially from both the lion and the tiger in that it is thoroughly at home in trees, running up a straight-stemmed and smooth-barked trunk with the speed and agility of a monkey. Moreover, the leopard is a much more active animal than the tiger, frequently taking tremendous leaps and springs. Mr. Sanderson is of opinion that the Indian leopard, although its powers of offense are far inferior to those of the tiger, is in some respects a more dangerous animal, as it is roused with less provocation, and is more courageous in attacking those who disturb its repose. The favorite resorts of the Indian leopard are rocky hills covered with scrub, among which it seeks secure hiding in caves and under overhanging masses of rock. From strongholds such as these, writes Mr. Sanderson, the leopards in Southern and Central India "watch the surrounding country towards sunset, and descend with astonishing celerity and stealth, under cover of the rocks, to cut off any straggling animal among the herds or flocks on their return to the village at nightfall. From their habit of lurking in the vicinity of the habitations of man, to prey upon cattle, ponies, donkeys, sheep, goats, and dogs, leopards* are

* In this extract we omit Mr. Sanderson's use of the word panther whenever he refers to the leopard.

frequently brought into collision with Indian villagers; and a leopard being mobbed in a garden or field of sugar cane or standing corn, from which he will charge several times, and bite and claw half a dozen before he is dispatched or makes his escape, is no uncommon occurrence in India. At night leopards frequently find their way into goat folds or calf pens, climbing over walls or the roofs of native huts in their burglarious inroads, and carrying off their prey with great boldness and agility. They appear to have a peculiar *penchant* for dogs; and I have known many villages in parts of Mysore where leopards were numerous, in which not a dog was to be found, or perchance but one or two, which would be pointed out by their owners as very lucky ones, they having escaped sometimes from the very clutches



LEOPARD ON THE PROWL.

of their unceasing foe, whilst their companions had successively fallen victims to his stealthy attacks."

This partiality of the leopard for dogs seems to be characteristic of the animal from one end of India to the other, and there are many instances on record where leopards in the hill stations have swooped down in broad daylight and carried off pet dogs from before the very eyes of their European masters or mistresses. It is but rarely that leopards take to man-eating, but instances do occur, one of which came under the notice of the present writer some years ago, when a leopard carried off a considerable number of persons from a village in Kashmir. In Africa the general habits of the leopard appear to be very much the same as in India, Sir Samuel Baker relating how, on one occasion, a dog was carried off from the very middle of his camp by one of these marauders.

In addition to dogs, which can, of course, be obtained only in the neighborhood of villages, leopards prey largely upon the langurs and other monkeys which haunt the rocky hills. Indeed, few animals come amiss in the way of food; about the largest which he is capable of killing being the sambar deer, or an Indian bullock.

In killing its prey, the leopard, writes Sir Samuel Baker, seizes by the throat, and clings with tenacious claws to the animal's neck, until it succeeds either in breaking the spine or in strangling the victim, should the bone resist its strength. When the animal is dead, the leopard never attacks the hind-quarters first, according to the custom of the tiger, but it tears the belly open and drags out all the viscera, making its first meal upon the heart, lungs, liver, and inside generally. It then retreats to some neighboring hiding place, and, if undisturbed, it will return to its prey a little after sundown on the following day. Mr. H. Hunter remarks that in Africa the leopard nearly always puts the remains of his "kill" up a tree, probably for the purpose of protecting it from the attacks of hyænas. On one occasion the skeleton of a lesser kudu antelope was found in the fork of a branch, which it was believed had been placed there by a leopard, and Mr. Hunter on several occasions saw one of these animals descending from a tree.

It has yet to be mentioned that the leopard does not display that marked partiality for the neighborhood of water so characteristic of the tiger, many of its haunts in the hills being in districts which are absolutely dry. On occasion, however, it will take to the water as readily, and swim as well as a tiger. Although usually found singly or in pairs, leopards, in Africa at least, may sometimes be found in parties comprising several full-grown individuals; probably, however, these are all members of a single family. The leopard is a still more silent animal than the tiger, seldom giving vent to any sound except when disturbed or charging an enemy, when it utters a short roar. According to Captain Baldwin, who is supported by Mr. Blandford, its real cry, which is but seldom heard, is quite different from the roar of a tiger, and takes the form of a harsh noise, something between a grunt and a cough, which is repeated three or four times. In India the female leopard gives birth to its young in the spring, during the months of February and March, two, three, or four cubs composing a litter. Young leopards are said to be more difficult to tame than either lions or tigers, and the adult when in captivity always displays an uncertain and morose disposition.

With regard to leopard hunting, Sir Samuel Baker observes that "it is far more difficult to circumvent a leopard than a tiger. The latter seldom or never looks upwards to the trees, therefore it does not perceive the hidden danger when the hunter is watching from his elevated post; but the leopard approaches his 'kill' in the most wary and cautious manner, crouching occasionally, and examining every yard of the ground before it, at the same time scanning the overhanging boughs, which it so frequently seeks as a place of refuge. Upon many occasions, when the disappointed watcher imagines that the leopard has forsaken its 'kill' and that his patience will be unrewarded, the animal may be closely scanning him from the dense bush, under cover of which it was noiselessly approaching. In such a case the leopard would retreat as silently as it had advanced, and the watcher would

return home from a fruitless vigil, under the impression that the animal had never been within a mile of his position. . . . There is very little sport afforded by this stealthy animal, and it is almost useless to organize a special hunt, as it is impossible for any correct opinion respecting its locality after it has killed an animal. It may either be asleep in some distant ravine, or among the giant branches of some old tree, or beneath the rocks of some adjacent hill, or retired within a cave, but it has no special characteristic or custom that would guide the hunter in arranging a beat according to the usual rules in the case of tigers."

Leopards are, however, much less suspicious of traps than are tigers, and still more so than lions, and, accordingly, a large number are thus caught. In India they are frequently taken alive in the cage trap, to which we have already referred under the head of the tiger; such traps being generally baited with a dog, goat, or calf, which attracts the leopard by its cries. In Africa a trap like a large fox trap is, however, generally employed; and so bold in some parts are leopards that Mr. Hunter states that once during dinner-time he caught one in a trap which was set within fifteen yards' distance of the table at which he was sitting.

THE SNOW-LEOPARD, OR OUNCE (*Felis uncia*)

The snow-leopard, or ounce, has been known to science for more than a century, but its habitat was long a mystery. This splendid animal is nearly allied to the leopard, from which it differs in the more arched form of the skull, as well as in coloration and its much longer fur. The long fur is thick, and almost of a woolly nature; the ground color of the upper parts being a pale, whitish gray, occasionally with a faint yellow tinge, passing into pure white beneath. The black spots are much larger than those of the leopard, and over the greater part of the skin form irregular rosettes, with the central area of each generally rather darker than the ground color of the fur. As in the leopard, the spots on the head, the lower portions of the limbs, and the extremity of the tail have no light-colored centres. A black streak extends from near the middle of the back to the root of the tail. The tail itself is remarkable for the length of its fur, scarcely diminishing in diameter from root to tip. The length of a specimen noticed by Mr. Blanford was seven feet four inches, of which three feet were occupied by the tail.

The snow-leopard inhabits the elevated regions of Central Asia. In Ladak it does not descend below the level of some nine thousand feet above the sea level in winter, while in summer it ranges to a height of eighteen thousand feet and upwards; in the Gilgit district of the Northwest Himalayas it is reported, however, by Dr. Scully to descend as low as six thousand feet in winter. The long and thick fur is specially adapted to protect the animal against the severe winter cold of the regions it inhabits. The beauty of the fur of a snow-leopard killed during the winter is unrivaled.

The northern range of the snow-leopard extends to the Altai mountains and some distance beyond, while to the northeast it embraces Amurland and the island of Saghalien. The animal is probably found all over Tibet, but how far to the westward of Gilgit it extends is at present unknown. It has, indeed, been reported

from Persia and Armenia; but it has now been ascertained that, so far as the latter country at least is concerned, this is owing to the long-haired variety of the leopard referred to above having been mistaken for the ounce.

Our knowledge of the habits of the snow-leopard is at present but limited, since comparatively few Europeans have seen the animal in its wild state. From living in a practically treeless country, it is probable that it is unable to climb. It preys chiefly upon wild sheep, and goats, and marmots, and other Rodents; it wages war upon domestic sheep and goats when grazing upon the higher grounds; and it will likewise, it is said, occasionally attack ponies. It is reported never to molest man. The writer once saw a snow-leopard in Ladak at a considerable distance. Only one living example of this animal has hitherto been brought to Eng-



THE SNOW-LEOPARD.
(One-tenth natural size.)

land. This was a young one, believed to have come from Bhutan, which was purchased by the Zoological Society in 1891, but did not long survive its arrival.

THE JAGUAR (*Felis onca*)

The jaguar is the largest representative of the Cat family inhabiting the New World, being somewhat superior in size to the leopard, and having a relatively-larger head. It agrees with the two preceding species in the ornamentation of the fur taking the form of large rosette-like dark spots, enclosing lighter centres; and likewise in the circular form of the pupil of the eye. The spots are, however, considerably larger than in the leopard; the ring of each being usually formed of a number of small spots, while the light centre of each rosette contains one or more



JAGUAR KILLING TAPIR.

W. Kuhnert.

spots. Moreover, the rosettes are arranged in from seven to eight longitudinal rows on each side of the body. The ground color of the fur is usually of a rich tan, the same tint obtaining in the middle of the rosettes. There is, however, a considerable amount of individual variation in the general color, and also in the arrangement of the spots. Examples from the more southern portions of the animal's range are stated to tend to a more yellow hue, sometimes becoming almost white; while in the region of the Orinoco there is, according to Humboldt, a darker variety, in which the dark brown fur is marked with scarcely distinguishable black spots, and some individuals are completely black. A variety from Mexico is characterized by the distance at which the small spots which ordinarily constitute the rings are placed from one another, so that complete rings or rosettes of spots only occasionally occur.

The skull may be distinguished at a glance from that of any of the other large cats by the presence of a well-marked tubercle near the middle of the inner side of the socket of the eye or orbit. The total average length of the jaguar may be set down at about six feet two inches, of which the tail occupies two feet one inch, equal to about one-third the length of the head and body. A large example measured by the naturalist Azara had, however, a total length of six feet nine inches, of which the tail occupied two feet two inches; while a still larger specimen is said to have measured upwards of five feet from the tip of the nose to the root of the tail. The range of the jaguar embraces the whole of the country lying between the north of Mexico and Texas and the northern parts of Patagonia; its southern limit coinciding approximately with the fortieth parallel of south latitude.

The jaguar is one of the most expert climbers among the larger cats; and it is stated by Humboldt, on the authority of the natives, that in certain districts of South America, where the forests are subject to inundation, and the trees stand so thickly that the passage from one to another is perfectly easy, the jaguar will sometimes take to an arboreal life, preying upon the troops of monkeys that inhabit the forests. All writers are agreed as to its ferocious nature and likewise as to its noisiness, Humboldt speaking very feelingly as to the loudness and frequency of its cries; but there is no record of its having attacked human beings without provocation.

Darwin states that in the forest districts of South America its favorite haunts are the wooded banks of rivers and the reed-clad margins of lakes. And it appears that in general the neighborhood of water is as essential to its well-being as it is to that of the tiger. But in the pampas of Argentina the jaguar inhabits a district where water is scarce, and where trees are practically unknown; and it is evidently capable of modifying its habits to a considerable extent in accordance with its surroundings. Writing of its occurrence in the pampas, Mr. W. H. Hudson, in his charming work, *The Naturalist in La Plata*, observes that probably only an extreme abundance of Mammalian prey, which has not existed in recent times, could have tempted an animal of the habits of the jaguar to colonize this cold, treeless, and comparatively waterless desert.

In the well-watered districts it is stated that the jaguar will sometimes prey to a considerable extent upon fish; and Humboldt relates that it is partial to the eggs

of the turtles which are so abundant on the Orinoco, and even to the turtles themselves, the flesh of which it scoops out with its paw from the shell. According to Darwin, in similar districts its common prey is the capybara, and when this animal is abundant, it seldom attacks any other. The mode of killing its prey is invariable. Leaping to the back of the victim, the jaguar, by a rapid movement of the fore-paws, twists its head round and breaks its neck. When the islands they usually inhabit are flooded, as is frequently the case, jaguars resort to the mainland to assuage their hunger, and are never so terrible as at such periods. There is a story that one of these gaunt, famished creatures, finding the door of the church of St. Fé open, went into the building. Two priests entering one after the other were killed; and a third, forewarned by the sounds of crunching and growling, escaped by a miracle. No one daring to go into the church to destroy the monster, a portion of the roof was taken off, and a deadly bullet aimed at him through the breach. At such times jaguars also prey largely upon cattle and horses. If driven from a carcass they will seldom return to it, preferring to hunt down another animal. When on the Amazon, Bates records how he once surprised a jaguar which had just made a meal off an alligator, the only parts of the reptile which were left unconsumed being the head, fore-quarters, and the solid bony armor.

Referring to the habit of scoring the bark of trees with its claws, possessed by the jaguar in common with other cats, Darwin observes that "one day when hunting on the Uruguay, I was shown certain trees to which these animals constantly repair, for the purpose, it is said, of sharpening their claws. I saw three well-known trees. In front the bark was worn smooth, as if by the breast of the animal, and on each side there were deep scratches, or rather grooves, extending in an oblique line, nearly a yard in length. The scars were of different ages. A common method of ascertaining whether a jaguar is in the neighborhood, is by examining these trees. I imagine that this habit of the jaguar is exactly similar to that which may any day be seen in the common cat, as with outstretched legs and extended claws it scrapes the leg of a chair. Some such habit must be common to the puma, for on the bare, hard soil of Patagonia, I have frequently seen scars so deep that no other animal could have made them. The object of this practice is, I believe, to tear off the ragged points of their claws, and not as the Guachos think, to sharpen them."

Like the other large cats, the jaguar takes to the water readily, and swims well. Its cry, which cannot be correctly described as a roar, is loud, deep, and hoarse, and has been compared to a series of repetitions of the syllables, *pu, pu, pu*. From two to four cubs are produced at a birth, which takes place about the end of the year. It is generally regarded as being of an utterly untamable disposition, even when captured young. Lady Florence Dixie succeeded, however, in rendering one of these animals perfectly docile, and even affectionate.

A peculiar animosity to the jaguar is displayed in the pampas by its near relative, the puma, Mr. Hudson observing that, "it is well known that where the two species inhabit the same district they are at enmity, the puma being the persistent persecutor of the jaguar, following and harassing it as a tyrant bird harasses an eagle or hawk, moving about it with such rapidity as to confuse it, and when an

opportunity occurs, springing upon its back, and inflicting terrible wounds with teeth and claws. Jaguars with scarred backs are frequently killed, and others, not long escaped from their tormentors, have been easily overcome by the hunters." This is the more remarkable since the puma is an animal of far inferior size and power to its adversary, although what it lacks in power it makes up in agility.

The Guachos of South America are in the habit of capturing the jaguar with the lasso; and Mr. Hudson relates a curious instance of how one of these fierce animals was absolutely paralyzed with fear, induced by a party of hunters who intended to capture it in this manner. These hunters had started the jaguar in an outlying district of the pampas, and it had taken refuge in a dense clump of dry reeds. "Though they could see it," writes Mr. Hudson, "it was impossible to throw the lasso over its head, and after vainly trying to dislodge it, they at length set fire to the reeds. Still it refused to stir, but lay with head erect, fiercely glaring at them through the flames. Finally it disappeared from sight in the black smoke; and when the fire had burnt itself out, it was found dead and charred in the same spot." Similarly, Livingstone relates how one of the harnessed antelopes of South Africa will lie close among burning reeds until its horns and hair are singed; both these instances being examples of the paralyzing effects of fear, analogous to that which causes a wolf when caught in a pit to lie perfectly still, even under the infliction of severe blows, as if simulating death.

Finally, it may be mentioned that, with the usual propensity for applying Old World names to New World animals and places, the jaguar is commonly known to the European inhabitants of South America as the tiger.

THE PUMA (*Felis concolor*)

As the jaguar in America usurps the name of the tiger, so its compatriot the puma is generally known there either as the lion, or the panther, or, as corrupted, *painter*. The animal is also known, more especially in works of natural history, as the couguar or cougar, which was abbreviated by the French naturalist Buffon from the Brazilian *cuguacu-ara* or *cuguacuarasua*. Puma appears to be the native Peruvian name, and is the one usually adopted by English-speaking zoologists. Next to the jaguar, the puma is the largest of the American cats; and it is the only large unspotted representative of the genus in the Western Hemisphere. From its extensive geographical range, the puma, as Mr. F. W. True well remarks, may be regarded as the most characteristic Mammal of America. In form, it is distinguished by the great relative length of the body, and the lithe build. The general color of its fur is a uniform tawny, passing into whitish on the under parts of the body; but there is a darker streak running along the middle of the back, and the extremity of the tail is dusky brown. The outer surfaces of the ears are black, with a whitish area near the middle; while the white upper lip is characterized by the presence of a conspicuous black spot in the middle line. In marked contrast to the black nostrils of the other large cats, those of the puma are flesh colored. Such is the general coloration, but it has been observed that, at least in North America, there is a seasonal variation in the color of the fur, which assumes in

summer a redder, and in winter a grayer tint. There is, moreover, considerable individual variation in this respect; but it does not appear that there is any constant difference dependent upon locality. Thus individuals of a yellowish-gray and yellowish-brown color are not uncommon, while much more rarely others of a brown, and nearly, if not quite, black hue are sometimes met with. Others, again, may be nearly white; and it is stated that albino pumas have been found in the Alleghany



THE PUMA.
(One-tenth natural size.)

mountains and New Mexico, but Mr. True, who has done so much to advance our knowledge of the species, states that this is not authenticated. Somewhat curiously it does not appear that the pelage of the puma varies in the length of the fur according to the temperature of the regions it inhabits, the animal being in this respect unlike the tiger.

The color of young puma cubs is very different from that of the adult, the fur on the body and limbs being marked with large blackish-brown spots, while the tail is ringed with the same color. These spots and rings remain more or less distinct till the cubs are about six months old, when they disappear to a greater or smaller extent, although they can generally be traced till the animal is mature, and may in some instances, especially when the fur is viewed in certain lights, continue through life. The presence of these spots in puma cubs is important, as showing that the uniform coloration of the adult is an acquired feature, and that the ancestors of the species were doubtless spotted at all ages.

In regard to the dimensions of the puma, it is stated by Mr. True that a male preserved in the museum at Washington has a total length (measured along the curves of the body) of 6 feet $7\frac{1}{2}$ inches, of which 2 feet $2\frac{1}{2}$ inches are occupied by the tail. A large male killed in Arizona measured 7 feet in total length, of which 3 feet were occupied by the tail; while a smaller male from the same locality had a total length of only 6 feet, of which the tail took up 1 foot 11 inches. The largest individual of which the measurements can be regarded as authenticated was one killed in Texas in the year 1846, of which the total length was 8 feet 2 inches, the length of the tail being 3 feet 1 inch. It is stated that a stuffed specimen measures 9 feet 1 inch in total length, while Mr. W. A. Perry considers that the length may in some instances be as much as 11 feet, which appears, however, somewhat improbable.

The geographical range of the puma in latitude is probably greater than that of any other Mammal, extending from New England and British Columbia in the north, to the extreme end of Patagonia in the south; while Mr. W. H. Hudson is of opinion that it has also occurred in Tierra del Fuego. According to Mr. True, in North America it does not even appear to have been met with in the states of New Hampshire, Rhode Island, New Jersey, or Delaware on the Atlantic coast, nor in Michigan or Indiana in the north. Another recent writer states that it is still abundant in Northern California, Oregon, Washington, British Columbia, and Alaska, and that it is most numerously represented in northern Washington, where it attains its largest size, and where the abundance of deer, grouse, and rabbits, and also of fish in the rivers, afford it an inexhaustible supply of food. In Ohio the puma was exterminated previous to the year 1838, while it appears to have become more recently extinct in the states of Illinois and Indiana. Like many of the other wild animals of the United States, the puma is rapidly retreating before the advance of civilization and cultivation, and it is probable, as Mr. True remarks, that in several of the more thickly-populated states not even stragglers now remain. In South America it appears to be abundant both in the forest districts of the great rivers, and likewise on the desert pampas; and in the latter area it largely exceeds the jaguar in numbers.

As might have been predicted from its immense geographical range, the puma is remarkable for its power of adapting itself to different climatic conditions and external surroundings. For instance, in the Adirondack mountains, near New York, where it is now nearly exterminated, the puma has to withstand a severe winter cold, during which it has to track its prey in the snow; and this is also still more

markedly the case in the regions near the northern limits of its range. On the other hand, the animal is equally at home in the hot and fetid swamps and cane-brakes bordering the rivers of southern United States, while in South America it is to be found alike on the treeless grassy pampas of Argentina and in the forests of the Amazon. Then, again, in the Rocky mountains, it is stated, on the authority of Mr. W. T. Hornaday, that the puma will ascend to the high elevations inhabited by the bighorn sheep, and its tracks have been observed on the summit of Mount Persephone in California, at a height of three thousand feet above the sea level, and in the Chilian Cordillera at an elevation of not less than ten thousand feet. In the Peruvian highlands the puma is also found in the highest forests, and even occasionally ascends to the limits of perpetual snow, while in the dense mountain forests of Central America it is commonly found as high up as eight or nine thousand feet.

As a rule, throughout the widely different regions included in its range, the puma selects for its lair localities affording a certain amount of concealment and protection, usually preferring thickets and copses to dense forests. In Mexico it has been observed that these animals are always met with in the most solitary spots, especially such as have a cover of thick bushes, or where there are rocks with caves. In the pampas of Argentina the puma probably has to make the best of the cover afforded by the tussocks of tall grass, or by the banks of the river courses.

In respect of the daring or otherwise of the puma, there is a considerable amount of discrepancy in the accounts of different writers. It is, however, probable that this diversity of view is mainly owing to the general refusal of the creature to attack human beings having been regarded as indicative of its general character, although diversity of habit in the southern and northern portion of its range is probably also in some degree a factor in the case. Writing of the animal's habits in South America, Mr. Hudson observes that, although the puma is undoubtedly possessed of marvelous courage and daring, yet the account given long ago by the naturalist Azara, that it will never attack or threaten to hurt either man or child, even when found asleep, is not only true, but actually understated. As a matter of fact, not only will the puma refrain from attacking man, but it will not even defend itself against him. It is from this circumstance that, in South America at any rate, the puma has earned its reputation for arrant cowardice. That it is in other respects a bold animal in South America Mr. Hudson unhesitatingly asserts, and he backs this opinion by stating that the puma invariably prefers large to small game, in desert regions killing peccaries, tapirs, deer, huanacos, rheas, etc. The number of huanacos killed by pumas in Argentina is attested by the number of their skeletons found on the pampas with dislocated necks, while, except in regions where prey is scarce, the number of slaughtered deer, with only the flesh of the breast eaten, shows the puma's fastidious habits. Those, observes Mr. Hudson, who have ever hunted the huanaco on the sterile plains and mountains know how wary and keen-scented it is, and consequently what powers of endurance and skill its pursuit must entail on the part of the pursuer.

In the parts of South America where cattle and horses are largely bred the puma is a terrible scourge. Indeed, so partial is it to horseflesh, that in some

parts of Patagonia it is almost impossible to breed horses owing to the destruction of their colts. An instance is related of a puma springing on a colt among a drove in charge of a driver, and killing it so suddenly by dislocation of the neck that the unfortunate animal was actually dead before it fell to the ground. It further appears that in districts where pumas abound the semi-wild horses of South America can scarcely maintain their existence, owing to the slaughter of their colts; and this leads Mr. Hudson to suggest that the indigenous horses, which inhabited South America during the Pleistocene epoch, may have been totally exterminated by pumas. The puma does not, however, confine its ravages on horses to the colts, but will also attack and kill full-grown adults. The same is true for cattle, among which calves more generally, and cows rarely, fall victims to the puma's rapacity. Horned cattle are, however, less preferred than sheep, which, next to horseflesh, form its favorite food in pastoral districts. Indeed, so partial are pumas to mutton, that one has been known to make use of a calf pen as a place of concealment from which to raid on a sheepfold, passing through the former without offering to molest its tenants.

The acme of daring on the part of the South American puma is, however, reached in the attacks which it makes upon the jaguar, to which allusion has been made when treating of the latter animal; and it appears that in North America the puma exhibits an equally marked hostility to the grizzly bear. In these respects the puma is undoubtedly entitled to be regarded as one of the boldest and fiercest of Carnivores in proportion to its size.

In regard to its gentleness toward the human race, it appears that so well known is this trait to the Guachos of the pampas as to have led them to apply to it the title of *amigo del cristiano*; and it is notorious that in places where pumas abound it is perfectly safe for a child to wander alone, and even sleep on the pampas. A traveler on foot on the pampas, who was compelled by stress of circumstances to make his nightly resting place beneath the shelter of a rock, related to Mr. Hudson that on one occasion four pumas, the two parents and their young, appeared as he was resting during the early part of a moonlight night. "Not feeling the least alarm at their presence, he did not stir; and after a while they began to gambol close to him, concealing themselves from each other among the rocks just as kittens do, and frequently while pursuing one another leaping over him. He continued watching them till past midnight, when they had left him." The same traveler also related to Mr. Hudson how he had once, and once only, killed a puma, adding that nothing would induce him to kill another. On the occasion referred to a puma was found, which sat perfectly still with its back against a stone, not even moving when lassoed. "My informant," writes Mr. Hudson, "then dismounted, and drawing his knife, advanced to kill it; still the puma made no attempt to free itself from the lasso, but it seemed to know, he said, 'what was coming, for it began to tremble, the tears ran from its eyes, and it whined in the most pitiful manner. He killed it as it sat there unresisting before him; but after accomplishing the deed, felt that he had committed a murder.'" If this were an isolated case, it would not be of much importance, but scores of instances attest that this strange and inexplicable behavior is characteristic of the South American puma, and that it almost

invariably resigns itself to death in this unresisting manner. Very different is, however, the behavior of the puma when attacked by a hunter accompanied by dogs. At such times, the animal is roused to the fiercest paroxysms of rage; and with hair erect and eyes flashing like balls of lurid fire, it rushes spitting and snarling on the dogs, utterly regardless of the presence of the hunter. So thoroughly indeed is the hunter ignored on such occasions, that he may actually belabor the puma on the head with a cudgel without drawing its attack upon himself; the animal receiving such blows without retaliation, and calmly waiting its opportunity of making a rush upon the dogs. Dogs seem, indeed, invariably to excite the puma to uncontrollable bursts of passion; and an instance is on record where one of these animals, when taken out of its cage and led by a chain, walked peaceably in front of a crowd of spectators, until, on catching sight of a dog, it suddenly broke away from control, and dashed violently among the people, who scattered in all directions.

One of the few instances known to Mr. Hudson, where a puma in South America has defended itself against a human being, was related to him by a Guacho. This individual, after an unsuccessful encounter with a jaguar, was riding on the pampas when "a puma started up from the long grass in his path, but made no attempt to run away; it merely sat up, he said, and looked at him in a provokingly fearless manner. To slay this animal with his knife, and so revenge himself for the defeat he had just suffered, was his first thought. He alighted and secured his horse by tying his fore-feet together, then, drawing his heavy knife, rushed at the puma. Still it did not stir. Raising his weapon he struck with a force which would have split the animal's skull open if the blow had fallen where it was intended to fall, but with a quick movement the puma avoided it, and at the same time lifted a foot and with lightning rapidity dealt the aggressor a blow on the face, its unsheathed claws literally dragging down the flesh from his cheek, leaving the bone bare. After inflicting this terrible punishment, and eyeing its fallen foe for a few seconds, it trotted quietly away." Eventually the wounded man recovered from his injuries.

As a culmination to its generally harmless character where man is concerned, there are stories current to the effect that the puma in South America will actually guard human beings when threatened with attack by other animals. Such an instance is related by Mr. Hudson, where a puma having placed itself by the side of a belated traveler on the pampas, attacked and drove off a jaguar, and this more than once. The narrator believes this anecdote to be strictly true, and remarks that the fact of a puma never making an unprovoked attack on man, and but rarely resisting him when attacked, is not really less wonderful than that it should follow him and come near him when alone in the wilderness, and even occasionally defend him from the jaguar, the common enemy of both.

Turning to North America, we find very similar accounts to those related above as to the serious injuries inflicted by pumas in the less settled districts on live stock. Thus in Mexico they are reported to kill large numbers of colts and calves, and on this account are poisoned by the herdsmen with strychnine. In California it is stated to be impossible to breed horses in one district, on account of the

ravages of these pests; and the destruction inflicted by them on calves and pigs is also considerable.

With regard to the behavior of the puma towards man, and its courage (or the reverse) in North America, the accounts to hand are not so circumstantial and definite as might be desired. All authorities are, however, agreed that it does not ordinarily attack human beings, and that when surprised it generally endeavors to make good its escape. Nevertheless, there are several instances on record where pumas have made such attacks, even in open daylight; among these we select two quoted by Mr. Perry. One case occurred in the spring of 1886, when some children from Olympia, Washington, were returning home from school. The eldest, a boy of twelve, noticed something that he thought was a large yellow dog, trotting on the road behind them. They paid no attention to it, as large mongrel dogs of this color abound everywhere in the vicinity of the Indian camps, but played leisurely along, as is the custom of children the world over. The youngest boy, a chubby little chap of six summers, who was behind his brothers, suddenly came rolling along in front of his brothers, and a moment later the great cat sprang over the heads of the two astonished boys, seized the little fellow in its mouth, and with a spring vanished from sight in the bushes. Mr. Perry proceeds to relate how the eldest brother, with nothing but an empty bottle, proceeded into the wood and heroically rescued the child, by beating the puma about the head until the bottle was smashed to atoms, and then attempting to gouge out the creature's eyes with the broken edges of the neck. The second instance occurred to a Swedish sailor named Joseph Jorgenson, in British Columbia. "The man had just commenced to clear a spot in the forest for the purpose of building a house, and was wielding his spade vigorously when suddenly his arm was seized as in a vise. He wheeled instantly, and found that his arm was in the jaws of a cougar. He was a young and powerful man, . . . so, without any preliminaries, he dealt his assailant such a kick in the stomach as to break its hold on his arm, and to lay it prostrate at his feet. The cougar instantly resented this rude treatment. Crouching, it sprang at its foe's throat, but he warded its head from his throat with his left arm, while with his right he dealt it a blow in the ribs that again prostrated it at his side. Quick as a flash it returned to the attack and seized him by the left hand, driving its fangs through the flesh and fearfully lacerating it. It was a fight for life, and Joe, with his brawny fists and heavy boots, beat and kicked the animal with such force that it released its grip on his hand and retired a short distance. Then it crouched and sprang at him again, landing on his breast and knocking him heavily against a tree; but again he cuffed and kicked it, until it again retreated and crouched for another spring. Fortunately Joe looking down saw the spade he had been using lying at his feet. Stooping quickly he grasped it just in time to ward off the cougar's spring by giving it a thrust with the spade. The brute fell at his feet, but instantly rose and seized him by the thigh. Maddened with pain, Joe made a gladiatorial thrust at the cougar's head. The sharp blade of the spade went crashing through its skull, and it fell dead at his feet."

To these instances of unprovoked attacks it may be added that the North American puma when attacked by man does not appear ever to exhibit that passive

nonresistance which is its most remarkable trait in South America. At the time when pumas were abundant in the Adirondack mountains, they were hunted in the snow during the depth of winter, when the hunter, in his snowshoes, made side circuits until he hit off a trail. Generally such a track led to the carcass of a deer recently killed and partially eaten. And here it may be remarked that in regard to their prey the Adirondack pumas differ from those of Argentina, in that, at least in winter, they will return again and again to a "kill," until the carcass is nearly or completely devoured. This may, however, be due to the circumstance that while in the hot plains of the Argentine the flesh of a slain animal would soon become tainted, it would remain fresh for a long period among the snows of the Adirondacks.

When such a "kill" is found the hunter looses his dogs, who soon succeed in finding the puma, which generally takes to a tree, but will occasionally stand at bay on the ground. "When attacked," writes Dr. Hart Merriam, who derives much of his information from a Mr. Sheppard, "they never spring after the dogs, but merely act on the defensive. When a dog makes bold to come too near, he receives such an energetic 'cuff' from the puma's* paw, that he rarely solicits another. Though possessed of great strength and power, and naturally quick in his movements, the puma is a positive coward. For all that, when seriously wounded, without being entirely crippled, all his latent ferocity is aroused, and he rushes fiercely at his assailants. But even at such times, when in an attitude of supreme anger and rage, and while lashing the snow impetuously with his long tail, anything thrust into his open mouth serves to divert his wrath from the enemy to his weapon. Thus on two occasions, once with an axe and once with the muzzle of his gun, has Mr. Sheppard saved himself and his dogs from mutilation, if not from a horrible death." From this it would appear that the Adirondack puma has not that intense antipathy to dogs which causes its Argentine cousin to rush on them with such ferocity. Whether the charge of arrant cowardice brought against the northern puma by Dr. Merriam is not partially due to some remnant of the passiveness exhibited by the southern form when attacked by man, is a question which may admit of argument.

We have already mentioned that in the wilder parts of South America, where domesticated animals are not obtainable, a large proportion of the food of the puma is formed by huanacos and deer, while in the northern part of its range deer are the only large animals preyed upon. It must not, however, be considered that the flesh of such animals forms in all cases the chief portion of the puma's diet. Thus, in the dense forests of the Amazon and Orinoco, where several Carnivores tend to assume more or less completely arboreal habits, it is related that pumas have been seen to chase monkeys from bough to bough, and from tree to tree; and it would thus seem that the flesh of the latter constitutes a considerable proportion of the food of the puma in those regions. Strange as it may at first sight appear, the pumas of the Adirondacks were wont to prey largely upon the porcupines which are found in abundance in that wilderness, and individuals were frequently killed with their mouths and lips, and sometimes other portions of their bodies, absolutely bristling

*In quoting from Dr. Merriam we have ventured to substitute the name puma for panther.

with the quills of porcupines. Whether, however, these animals were selected as an article of food from choice, or whether the pumas were driven to devour them from inability to capture other prey, is uncertain. Be this as it may, porcupines are creatures which, from their sluggish habits and contempt of ordinary foes, may be easily captured, and would be sure to come in the way of the puma during its nocturnal wanderings. Mr. Perry states that the North American puma will eat almost anything, from deer down to rats, mice, fish, and even snails. In the pampas of South America the puma, in addition to the larger animals already mentioned, is stated to prey upon large Rodents like the aguti and the paca, and likewise upon the coati, while it is also said to kill and eat the noisome skunk. The rhea, or South American ostrich, is also at times hunted by the puma on the pampas, while in New Mexico and Arizona, according to Messrs. Coues and Yarrow, so severely are the wild turkeys persecuted by it that many hundreds are killed annually, and several of their old breeding places have become completely deserted. When extremely hard pressed by hunger, the puma is said not even to disdain a meal of carrion.

Like most of the larger felines, the puma seeks its prey mainly by night and during the morning and evening twilights, but it hunts occasionally by day. Deer are stalked after the usual stealthy manner of the cat tribe, and when approached within striking distance are rushed upon in a series of successive leaps, unless, indeed, the puma can spring upon them from an elevation, when a single leap will suffice. If not caught within a few leaps, the deer commonly escapes, as its foe then gives up the chase. The leaping powers of the puma are prodigious, and it is said that when pursued by dogs it has been known to spring upwards and reach a bough at a height of twenty feet from the ground, while horizontal leaps of the same distance are by no means uncommon, and an instance is on record where the length of a leap on snow was close upon forty feet. Authorities are now generally agreed that the puma kills the larger animals by springing upon their shoulders and dislocating the neck. In the northern portion of its range during the winter the puma will on occasions pursue deer for long distances when they are incapable of rapid flight owing to the depth of snow on the ground.

The number of young produced at a birth varies from one to four or five; but apparently two is the ordinary number, more especially when in captivity. In the Adirondacks, according to Dr. Merriam, the young are born toward the close of winter or the beginning of spring, the lair being usually situated in a shallow cave on the face of a steep cliff or ledge of rock. And it would appear that in the same district the female does not give birth to offspring more frequently than every other year. In the southern portions of the United States where caves and rocks are wanting, Audubon states that the lair is made in a dense thicket or canebrake, and constructed of twigs, leaves, and moss, with an overarching roof of evergreen canes, which forms an efficient protection against rain at all seasons of the year. The young when first born are from ten to twelve inches in length; they open their eyes on the ninth or tenth day. The age which the puma attains is not yet ascertained, but one kept at Frankfort for sixteen years died from an accident while in full health and vigor.

Although the works of the older writers abound with references to the piercing cries and startling screams of the puma, it would seem that in general the animal is silent. Darwin states that in South America the only occasion on which it utters any sound is during the breeding season, and even then but rarely, while, when wounded, it always remains silent. From accounts given him by the hunters of the Adirondacks, Dr. Merriam came to the conclusion that the screams of the puma were a total myth, the cries which have been attributed to it being uttered by other animals. Against this, it may be observed that Messrs. Kennerby and Schott, when surveying in Mexico in 1858, state that on more than one occasion they heard loud cries which they attributed (on what evidence does not appear) to the puma. Moreover, Dr. J. A. Allen in Colorado, and Mr. D. G. Eliot in Florida, speak of having heard the puma's cry, although the latter writer, at any rate did not see the animal. More important is the observation recorded by Mr. Schott to the effect that a puma killed on the Rio Bravo, between Fort Duncan and Laredo, "during his struggle with the hunters and dogs raised a terrible cry, twice or thrice to express his rage, and perhaps also to give his family the notice of danger." It would seem, therefore, that, although generally a silent creature, the puma may on rare occasions—and more especially when wounded—give vent to a cry or scream, which is described as being of the most weird and unearthly nature.

When captured young, pumas thrive well in captivity, and are gentle and affectionate in disposition towards human beings, although they but rarely overcome their innate antipathy to dogs. If, however, not taken till adult, they appear in all cases to pine and languish. Mr. Hudson writes that "the puma, is with the exception of some monkeys, the most playful animal in existence. The young of all the *Felidæ* spend a large portion of their time in characteristic gambols. The adults, however, acquire a grave and dignified demeanor, only the female playing on occasions with her offspring, but this she always does with a certain formality of manner, as if the relaxation were indulged in not spontaneously but for the sake of the young, and as being a necessary part of their education. . . . The puma at heart is always a kitten, taking unmeasured delight in its frolics; and when as often happens, one lives alone in the desert, it will amuse itself by the hour fighting mock battles, or playing at hide-and-seek with imaginary companions, and lying in wait and putting all its wonderful strategy in practice to capture a passing butterfly. Azara kept a young male for four months, which spent its whole time playing with the slaves. This animal, he says, would not refuse any food offered to it; but when not hungry it would bury the meat in the sand, and when inclined to eat it would dig it up, and, taking it to the water-trough, wash it clean. I have only known one puma kept as a pet, and this animal, in seven or eight years had never shown a trace of ill-temper. When approached, he would lie down, purring loudly, and twist himself about a person's legs, begging to be caressed. A string or handkerchief drawn about was sufficient to keep him in a happy state of excitement for an hour, and when one person was tired of playing with him he was ready for a game with the next comer."

A tame puma, of which the skeleton is now preserved in the Museum of the Royal College of Surgeons, was kept as a pet by Edmund Kean, the actor. It

would follow its master loose, like a dog, and was often brought into his drawing-room when visitors were present. Jardine, writing of this animal, states that it was extremely gentle and playful, and showed no symptoms of ferocity to the strangers who came to see it. Its motions were all free and graceful, and it exhibited the greatest agility in leaping and swinging about the joists of a large unoccupied room in the old college of Edinburgh.

Fossil remains of the puma have been found in the superficial deposits of several districts in the United States which probably belong to the Pleistocene period. It may also be mentioned that fossil bones of the jaguar occur in the celebrated caverns of Lagoa Santa, in Brazil, in company with those of a number of gigantic extinct Mammals. Both these cats are, therefore, comparatively old species.

THE CLOUDED LEOPARD (*Felis nebulosa*)*

With the clouded leopard, or, as it is often less appropriately called, the clouded tiger, we revert to the cats of the Old World. This handsomely-colored animal, which may be regarded as the last of the very large cats, is a long-bodied and short-legged species, usually provided with a very long tail, and of thoroughly arboreal habits. The head is of a more elongated form than in any of the species yet noticed; while the pupil of the eye is oval, with its longer diameter vertical. The ground color of the fur varies from grayish to yellowish brown, passing into whitish beneath; the markings on the body taking the form of narrow vertical stripes and blotches of black, which form large irregularly-arranged patches. On the sides of the face there are always two distinct black stripes, arising respectively from behind the eye, and from above the angle of the mouth; of which the former extends behind the ears to join the black markings of the back. The upper parts of the head and the limbs are ornamented with spots; while the tail has a number of dusky rings, which are not infrequently incomplete. The skull may be recognized by its low and elongated form, as well as by the great relative length of the upper tusks, or canine teeth, which are proportionately longer than in any other living species of cats.

In size the clouded leopard may be compared to a small individual of a true leopard. One male measured five feet seven and one-half inches in total length, of which two feet six inches were taken up by the tail; while another reached six and one-half feet, of which three feet were occupied by the tail. The length of the tail in these specimens is thus about equal to four-fifths of that of the head and body, but there is a variety from the island of Formosa in which the tail is much shorter.

The clouded leopard is confined to the southeastern parts of Asia, ranging from the Eastern Himalayas, in the districts of Bhutan and Sikkim, to Assam, and thence to Burma, the Malay Peninsula, and the islands of Borneo, Sumatra, and Java. The short-tailed variety, found only in the island of Formosa, probably indicates that the distribution of the series on the mainland of Asia was formerly more extensive than at present.

*Also known as *F. macrotis* and *F. diardi*.

To the Malays the clouded leopard is known as the Rimau-dahan, or Arimau-dahan, meaning the tiger of the trees; the word *dahan* signifying the forked branch of a tree. According to Mr. Blanford, the whole of our limited knowledge of the habits of this species is derived from the reports of native hunters, and is not, therefore, in all respects trustworthy. That it passes almost the whole of its time in



THE CLOUDED LEOPARD.
(One-tenth natural size.)

trees, on the branches of which it sleeps, is, however, thoroughly ascertained; and it appears that its food consists chiefly of birds and small Mammals.

THE MARBLED CAT (*Felis marmorata*)

The marbled cat from the Eastern Himalayas, Assam, Burma, and the Malayan region, is a much smaller species, agreeing in the general characteristic of its markings with the clouded leopard. In size this beautiful little species is somewhat larger

than a domestic cat of average dimensions ; the length of the head and body, according to Mr. Blanford, varying from eighteen and one-half to twenty-three inches, and that of the tail from fourteen to fifteen and one-half inches. The fur is characterized by its thickness and softness ; and in Himalayan specimens, at least, has an under fur of a woolly nature.

From the resemblance of its coloration to that of the clouded leopard (in which the marbled fur harmonizes with the gnarled and knotted boughs on which the animal reposes), it may be inferred that the marbled cat is likewise an arboreal species.



THE MARBLED CAT.
(One-fifth natural size.)

The Tibet cat (*Felis scripta*), from Eastern Tibet, is another small-sized species allied in coloration to the clouded leopard.

THE GOLDEN CAT (*Felis temmincki*)

The golden or bay cat is a well-marked Indian species, of somewhat inferior dimensions to the clouded leopard, and readily distinguished by its deep ferruginous

or chestnut color, which passes into bay along the line of the back ; the under parts and chin, as well as the lower surface of the tail, being whitish or white. There are some dark spots on the chest, while the face has some characteristic but variable markings.

The golden cat is found in the Southeastern Himalayas, from whence it extends northwards into Tibet ; while in the opposite direction its range embraces Burma, and a considerable part of the Malayan region, although its exact limits are unknown. Nothing is known as to the habits of this cat, but from its coloration it would appear probable that it frequents sandy or rocky districts.

THE FISHING-CAT (*Felis viverrina*)

The fishing-cat of India, which is somewhat larger than the ordinary domestic cat, derives its name from its peculiar habit of living to a great extent upon fish,



THE FISHING-CAT.
(One-eighth natural size.)
(After Wolf.)

which it captures for itself. This species is a short-limbed, spotted cat, with a circular pupil to the eye, the tail about equal in length to one-third the length of the head, and the short and coarse fur lacking the beautiful shining gloss characteristic of most of the other members of the family. The head is somewhat elongated, and the ears are short and rounded. The general ground color of the fur is usually some kind of gray, with a more or less brownish tinge ; the back being darker and browner, and the under parts, as usual, whitish. The spots, which may be either dark brown, or of a full black color, have no light centres, and are always much longer than broad, although they are subject to considerable individual variations in shape and size ; they cover the whole of the body. The head is marked by a number of

longitudinal stripes, starting from the forehead and running to the nape of the neck ; these becoming broken up on the shoulders, but reappearing along the back as a line of spots. The grayish-white cheeks are generally crossed by two dark streaks ; and the limbs are usually barred and spotted, more especially on their outer sides, although occasionally uniformly colored. The tail has its upper surface marked with more or less distinctly defined dark rings. Altogether, the coloration of the fishing-cat reminds us of some varieties of the domestic "tabby."

A fair-sized male of the fishing-cat will have a total length of about forty-one and one-half inches, of which the tail (the hair at its tip being included in the measurement) will take up about eleven and one-half inches. The height of such an animal at the shoulders will be about fifteen inches.

The skull of the fishing-cat may be distinguished from that of any of the species yet mentioned by the circumstance that in fully adult individuals the socket of the eye is completely surrounded by bone in almost all cases. In this respect the skull resembles that of a monkey and differs from that of most Carnivores, although a similar feature is displayed in the skulls of some of the other small Indian cats, and also in those of the ichneumons, noticed later on. We have occasionally seen the skull of an adult domestic cat, in which the bony ring behind the socket of the eye is almost complete.

The geographical range of the fishing-cat extends from India to Southern China ; but its distribution in the countries it inhabits appears to be somewhat local. Thus, instead of occurring all over India, this cat, according to Mr. Blanford, is unknown in the peninsula, except on part of the Malabar coast. It occurs, however, in Ceylon, and is found along the flanks of the Himalayas as far westward as the independent state of Nipal. Thence it extends into Burma, the Malay Peninsula, and the south of China ; but, somewhat curiously, it appears to be absent from the great Malayan islands, such as Sumatra and Borneo. The species is, however, said to reappear in the island of Formosa ; which, if confirmed, will show that its distribution will accord very closely with that of the clouded leopard.

This cat is found in the neighborhood of thickets bordering lakes, swamps, and rivers, and is stated to be far from uncommon in the neighborhood of Calcutta. It does not appear that it has been observed by any European in the act of catching the fish which form such a considerable portion of its diet, and an account of the mode in which the capture is effected would be of much interest. In addition to fish it has been stated on good authority that this cat is also a consumer of the large mollusks found so abundantly in the swamps of India, and one specimen is known to have eaten a snake. Probably, however, almost any kind of food is equally acceptable to the fishing-cat, which doubtless catches all the smaller animals that come within reach of its clutches. All writers who have seen it in the wild state bear testimony to the fierce and savage disposition of this species ; and it is on record that it has been known to destroy not only sheep, calves, and dogs, but also to carry off native infants which have been left unguarded. In reference to these destructive habits, a correspondent, quoted by Mr. R. A. Sterndale, observes that the fishing-cat generally "takes up its quarters in low swampy jungles, where it often carries off calves, for which the leopard undeservedly gets credit. Lately, a couple of months

ago, a pair of them at night broke into a matted house, and went off with a brace of ewes, which had half a dozen lambs between them. . . . I have caught this species in traps, and when let loose in an indigo vat, with a miscellaneous pack of dogs, they have invariably fought hard. . . . Some years ago one got into my fowl-house at night, and just as I opened the door to enter, it made a fierce jump at me from a perch on the opposite side." The most remarkable instance of the ferocity of this cat is, however, related by Blyth. In this case a newly-caught male of the fishing-cat was put into a cage separated by a thin partition from one containing a tame female leopard, which, although young, was about double the size of the fishing-cat. The latter succeeded, however, not only in breaking through the partition between the two cages, but in actually killing the leopard, although it made no attempt to eat its flesh.



THE LEOPARD-CAT.
(One-sixth natural size.)

THE LEOPARD-CAT (*Felis bengalensis*)

The pretty little cat from Southeastern Asia, commonly known as the leopard-cat, is subject to such an extraordinary amount of individual variation in color and markings that it has received no less than fifteen separate scientific names, such variations having been regarded as indicating distinct species.

In size it has been compared by Mr. Blanford to a rather small domestic cat, with relatively longer legs. The pupil of the eye is circular in ordinary light, and the length of the tail usually varies from about one-third to rather less than one-half that of the head and body. Usually the head and body measure together from twenty-four to twenty-six inches, while the tail has a length of from eleven to twelve

inches, or rather more. Although this species comes under the denomination of spotted cats, with the spots much longer than broad and without light centres, yet the amount of variation is so great that it is almost impossible to give a description that will hold good for all the varieties. The ground color of the upper parts is, however, very generally some shade of pale tawny, varying from rufous to grayish ; while the spots which have a more or less marked tendency to form longitudinal lines, may be either wholly black, or partly black, and partly brown. The spots extend over the under parts and limbs and the upper part of the tail ; although the tip of the tail is barred. Four distinct longitudinal stripes on the forehead give a characteristic physiognomy to the head, these stripes being generally continued in a more or less distinct manner along the back.

This cat is exclusively a forest-dwelling species, and is found in many parts of India, such as the outer Himalayas, as far westward as Simla, the greater part of Lower Bengal, the Western Ghats on the Bombay side of the peninsula, and the Wynaad and Travancore districts in Madras. According, however, to Mr. Blanford, it is probably unknown in Ceylon. Eastward of the Himalayas its range includes Assam, Burma, the Malay Peninsula, the southern part of China, and the islands of Borneo, Sumatra, and Java, as well as the Philippines.

It would be tedious to indicate the different varieties of this cat, but it may be observed that, according to the writer last mentioned, while one set of varieties are characterized by the tendency to a gray tinge in the ground color, others display an equally marked inclination towards a rufous hue. Blyth states that some of the gray varieties are hybrids with the domestic cat.

Although invariably found in forest districts, the leopard-cat is not confined to the hills, as it occurs in the sandarbans of Bengal at the level of the sea. Its prey consists of small Mammals and birds, and it is said to breed in the spring, when it produces from three to four kittens at a birth ; the lair being generally in a cave or under an overhanging cliff. In spite of its small size, the leopard-cat is a ferocious and spiteful animal, in captivity generally keeping curled up during the daytime in a dark corner of its cage, instead of pacing up and down in the usual restless feline manner. Blyth, who was unusually successful in taming wild creatures, confesses to having utterly failed in all his efforts to conciliate the leopard-cat, and his experience is confirmed by many others who have had to do with the animal. Mr. Blanford states, however, that a specimen in the London Zoological Gardens appeared thoroughly tame, and would answer readily to the call of its keeper. The depredations of this cat appear to be conducted with great boldness, General M' Master stating that he saw one carry off a fowl nearly as large as itself, shaking it savagely meanwhile, and making a successful retreat, in spite of the abuse, uproar, and missiles which the theft caused.

THE SERVAL (*Felis serval*)

With the serval we come to a well-known African cat of much larger dimensions than either of the three preceding species. It is a spotted cat, easily recognized by the great length of its legs and the comparative shortness of its tail,

which is considerably less than half the length of the head and body. The ground color of the fur is generally of a light tawny, becoming whitish beneath. The black spots are generally small and widely separated, but in the middle line of the back tend to run together in streaks. The cheeks and forehead lack the dark stripes found in so many of the smaller spotted cats, but there are two very characteristic horizontal black bands on the upper part of the inner surface of each foreleg, by which a skin of this species may be recognized at a glance. The tail is



THE SERVAL.
(One-sixth natural size.)

ringed throughout with black, and has a tip of the same color. In well-grown adult examples the total length may reach four feet eight inches, of which sixteen inches are occupied by the tail. This cat is found from one end of Africa to the other, but appears to be more common in the south than in the north. Its "leggy" build and poor coloration render the serval a by no means handsome representative of the family.

Owing to the general lack of attention paid to them by the majority of sportsmen and travelers, we have far less information as to the habits and mode of life of the smaller cats of Africa and South America than we possess with regard to those of India, where a host of careful observers have made us tolerably well acquainted with most of the Mammals in their wild state.

In East Africa, as we are informed by Mr. H. C. V. Hunter, the serval inhabits the grassy plains at the foot of Mount Kilima-njaro, where it is not uncommon. It also ranges to an elevation of five thousand feet or more on the flanks of the mountain. At that elevation a black specimen was obtained by Mr. Hunter, and, since the natives have a separate name for this black variety, it must be comparatively common. In a black skin from South Africa in the British Museum the spots are distinctly visible when the skin is viewed in certain lights.

Omitting mention of certain little-known species of cats from Western Africa, such as the golden-haired cat (*Felis rutila*) of Sierra Leone and the Gambia, the gray African cat (*F. neglecta*) from the Gambia, and the servaline cat (*F. servalina*) from Sierra Leone, we proceed to the consideration of two small Asiatic species.

THE RUSTY-SPOTTED CAT (*Felis rubiginosa*)

It is somewhat remarkable that as India is inhabited by the two largest living representatives of the Cat family, so it also includes the smallest member of the group. The species which has the honor of occupying the latter position is the pretty little animal known as the rusty-spotted cat, which is of somewhat smaller dimensions than an average domestic cat. Its general ground color is ruddy gray, passing into white below, while the body and limbs, but not the tail, are spotted. In some examples, however, the red tinge is greatly developed at the expense of the gray. The individual hairs vary in color in different portions of their length. The dark spots on the back and sides are longer than broad, with a more or less marked tendency to arrange themselves in longitudinal lines, and the species derives both its popular and its scientific name from their general rusty-red hue. In the reddish variety, which is characteristic of Ceylon, the spots are, however, brownish black. As in so many of the smaller Indian cats, the forehead is marked by longitudinal dark stripes, four in number, and there is also a stripe on each side of the face behind the eye. The species is quite peculiar among the spotted cats in having the tail without either spots or rings, its upper surface being of the same tint as the back, while the under part is paler. In length the rusty-spotted cat varies from sixteen to eighteen inches from the tip of the snout to the root of the tail, the length of the tail being constantly nine and one-half inches.

The skull agrees with that of the fishing-cat in having the sockets of the eyes completely surrounded by bone, but it is peculiar in that there are never more than two premolar teeth in the upper jaw, that is to say, there is only one of these teeth in advance of the flesh-tooth.

This cat inhabits Ceylon and Southern India, rarely extending as far northwards as the Central Provinces, and being quite unknown on the Malabar coast. Its fossil remains have been obtained from a cavern in Madras, thus proving that it

was an inhabitant of India at a time when the fauna of that part of the country had a much closer affinity to the fauna of Africa than exists at the present day. The late Dr. Jerdon, in his *Mammals of India*, observes that, "this very pretty little cat frequents grass on the dry beds of tanks, brushwood, and occasionally drains in the open country and near villages, and is said not to be a denizen of the jungles. I had a kitten brought to me very young in 1846, and it became quite tame, and was the admiration of all who saw it. Its activity was quite marvelous, and it was very playful and elegant in its motions. When it was about eight months old, I introduced it into a room where there was a small fawn of the gazelle, and the little creature flew at it the moment it saw it, seized it by the nape, and was with difficulty taken off. I lost it shortly after this. It would occasionally find its way to the rafters of bungalows and hunt for squirrels. Sir W. Elliot notices that he has seen several undoubted hybrids between this and the domestic cat, and I have also observed the same."

In commenting upon this account, Mr. Blanford observes that the alleged absence of the species from jungles is probably incorrect, for it has been found inhabiting forests in Ceylon. A pair of kittens of this species were at one time in the possession of Mr. R. A. Sterndale, and proved quite as tame, active, and graceful as the one mentioned above. After the death of one of the pair from a snake bite, the kitten of a domestic cat was obtained as a playfellow for the survivor, when the difference in the agility of the two creatures was very markedly exhibited.

THE FLAT-HEADED CAT (*Felis planiceps*)

The flat-headed cat is the second uniformly-colored species, in addition to the lion, among the Old World cats. It is about the size of a domestic cat, but with a relatively-longer body, shorter legs, and shorter tail; the length of the latter being not more than from one-quarter to one-third that of the head and body. The fur is long and soft; and on the upper parts it is of a dark rich reddish-brown color, having a curious speckled silvery appearance, due to some of the hairs having white tips. In many specimens, at least, a pair of yellow lines diverge from above the nose on to the forehead between the eyes. The under parts are whitish, more or less splashed with brown. The length of the head and body varies from twenty-one to twenty-four inches, while that of the tail is not more than from six to eight inches.

The skull of this cat resembles that of the preceding species in having the sockets of the eyes surrounded by bone; but differs in having three premolar teeth in the upper jaw, the first of which is relatively larger than in any other living cat. The flat-headed cat has been obtained from the Malay Peninsula and the islands of Sumatra and Borneo; but nothing appears to have been hitherto ascertained as to its habits in the wild state.

Another uniformly-colored cat, with fur of a bright chestnut tint, has been described from Borneo, under the name of the Bornean bay cat (*F. badia*). The tail is relatively longer than in the flat-headed cat.

THE OCELOT (*Felis pardalis*)

If not equal in beauty of coloration to its much larger cousin the jaguar, the smaller South American cat known as the ocelot occupies at least the next place in this respect ; and exhibits individual variations fully as marked as those occurring in the Asiatic leopard-cat. The ocelot is essentially a South American species, ranging northwards, however, into Mexico, and just impinging on the extreme southwestern borders of the United States. Southwards it extends to Paraguay ; but, according to Mr. W. H. Hudson, it is unknown on the pampas of Argentina, from which it may be inferred that its alleged occurrence in Patagonia is, at least, open to doubt. Like the leopard-cat, the ocelot, on account of its numerous vari-



THE OCELOT.
(One-sixth natural size.)

ations in color, has received a number of distinct scientific names. Professor Mivart, describes the more general type in the following words : "The ground color of the ocelot may be tawny yellow or reddish gray. It is always marked with black spots, which are aggregated in chain-like streaks and blotches, generally forming elongated spots, each with a black border, enclosing an area which is rather darker than is the general ground color. The head and limbs bear small spots, and there are two black stripes over each cheek, and one or two transverse black bands within each fore-leg. The tail tends to be ringed, and the ventral parts of the trunk and limbs are whitish."

There is, however, a well-marked variety of a gray color, in which the flanks may be whitish; while there is a second form characterized by its less brilliant coloration, the wider interval between the blotches, and the lighter color of the areas enclosed by the black lines. Still more strikingly different is the third form, characterized by the fullness and intensity of its coloration, the ground color being bright fulvous, and the black markings exceedingly numerous and deep, while the white parts stand out in strong contrast to the rest. The pupil of the eye, when contracted, forms an exceedingly narrow vertical slit. Not only does the ocelot vary in coloration, but it also displays considerable individual difference in point of size. Thus the total length of the animal may vary from four feet to three feet one inch, and that of the tail from fifteen to eleven inches.



THE MARGAY.
(One-seventh natural size.)

The ocelot appears to be an exclusively forest animal, and is said to be an expert climber, capturing most of its prey, which consists of small Mammals and birds, in the trees. In disposition it is described as fierce and savage in the wild state. Jardine gives an account of a young specimen in captivity, which was excessively playful, and fond of climbing, especially on the visitors, and was fairly tractable, although its docility depended to some extent upon the nature of its food.

THE MARGAY (*Felis tigrina*)

The margay is another American forest-dwelling species, which likewise exhibits considerable variation in color and size; its range extending from Mexico to Paraguay.

The ordinary variety, according to Professor Mivart, "has rather harsh fur, of a dull grizzled color, varied with black spots and rings. The tail is marked with small black spots, often confluent, but not forming rings. There are three transverse black stripes on the cheek. The head and body measure together a little over twenty-four inches, and the tail is about eleven inches long." There are, however, two well-marked varieties, one of which is known as the chati, while the other, represented in our figure on page 422, has been called *F. macrura*; both of these being characterized by the softness of their fur, their bright fulvous color, and the circumstance that their spots, which vary much in size, do not run together so as to form the chain-like pattern of the typical form. In some cases the black patches enclose central areas of a paler tint. In these varieties the length of the head and body may be but little short of twenty-seven inches; while the length of the tail varies from fourteen to nineteen inches.

Another spotted cat, exclusively confined to South America, is Geoffroy's cat (*F. guigna*). It has generally been regarded as confined to the forest regions of Chili and Peru, but, according to Mr. W. H. Hudson, is also found on the Argentine pampas, where it is known as the woodcat. Like the jaguar, it is, as Mr. Hudson remarks, probably there as an intruder from wooded districts to the northward of the pampas.

THE JAGUARONDI (*Felis jaguarondi*)

The jaguarondi, inhabiting Brazil, Guiana, Paraguay, and Northeast Mexico, but not extending to the northward of the Rio Grande, differs from all the American species yet noticed, with the exception of the puma, by its uniform coloration. In form it is characterized by its long body, short limbs, and the great length of the tail, which is nearly as long as the head and body. Its general color is blackish or brownish gray, but, as in so many variable species, there is a tendency to the special development either of an unusually grayish or an unusually rufous tinge. The total length of the cat is about four feet seven inches, of which two feet one inch are occupied by the tail. The pupil of the eye is stated to be round; and the species is especially characterized by the peculiar manner in which the nose is, so to speak, pinched in from side to side.

THE EYRA (*Felis eyra*)

Strangest in form of all the cats is the South American eyra, which, from its long body, short legs, low withers, high rump, and extremely long tail, might almost be mistaken for a member of the weasel family, were it not for its relatively shorter face. In size it is almost equal to a rather small domestic cat, but with proportionately shorter legs. The fur is soft and of a uniform coloration, varying in tint from reddish yellow to a brilliant chestnut, with the exception of a distinct whitish spot on each side of the upper lip. The pupil is round, and the skull still more elongated and depressed than in the jaguarondi, to which it is evidently closely allied, although the nose is not so much pinched in at the sides as in that species.

The range of the eyra is practically coextensive with that of the jaguarondi. And both species are described as being equally bloodthirsty in disposition, playing sad havoc with the fowls of the inhabitants of the districts which they frequent. The eyra, as might have been expected from its weasel-like shape, is, however, the more lithe and active of the two.

THE COLOCOLLO (*Felis colocollo*)

Almost the last of the true American cats that will be noticed here is the imperfectly known and rare colocollo, easily distinguished from all the other members of the family by its remarkable coloration. The colocollo is, perhaps, rather larger than an average domestic cat; and is of a grayish-white ground color, ornamented with dashes of black on the back and sides, and further distinguished by a black



THE EYRA.
(One-eighth natural size.)

streak running from the eye to the jaw. The tail is described as being imperfectly ringed with dark bands, while the lower limbs are dark gray. It has been recorded from Guiana and Chili, but doubtless also inhabits the intervening states.

THE CAFFRE, OR EGYPTIAN CAT (*Felis caffra*)*

With the caffre, or, as it is frequently termed, the Egyptian cat, we come to a species of more than ordinary interest, since, by many authorities, it is regarded as the parent stock from which the domestic cat of Europe has sprung.

* Also known as *F. caligata* and *F. maniculata*.

The caffre cat is about the size of a large domestic cat, and is generally of a yellowish color (becoming more or less gray in some specimens), darker on the back, and paler on the under parts. The body is marked with faint, pale stripes, which assume, however, on the limbs, the form of distinct dark horizontal bands; and the tail, which is relatively long, is also more or less distinctly ringed towards its tip, which is completely black. The sides of the face are marked by two horizontal streaks. Very generally the soles of the hind-feet in this cat are black, although in the paler-colored varieties this part is not darker than the back.

The caffre cat has a wide distribution, being found throughout Africa, from the Cape to Algiers and Egypt, and also extending into Southwestern Asia in Syria and Arabia. In past times it also ranged into Southeastern Europe; its fossilized remains having been obtained from the caverns of the rock of Gibraltar, in company with those of several extinct species of Mammals. At the period when the caffre cat lived in Gibraltar, Spain was doubtless connected by land with Africa. These cats, as is well-known, were held sacred by the ancient Egyptians, and enormous numbers of their bodies were embalmed and preserved in tombs and pits; the largest repositories being found in the cities of Bubastis and Beni-Hassan. The cats found in the tombs of the two localities mentioned are regarded by Professor Virchow, who has devoted much study and attention to this subject, merely as tamed individuals of the wild caffre cat, and having no sort of relationship with the domestic cat; the origin of which, it is considered, is to be sought in Europe or Asia. On the other hand, Dr. A. Nehring,* of Berlin, whose opinion is entitled to much weight, considers that the black sole of the hind-foot, common to the caffre cat and the domestic cat of Europe, is indicative of the descent of the latter from the former, although it is quite probable that there may be also a strain of Asiatic blood in our cats. And much the same opinion is entertained by Professor Mivart. In this connection it is important to notice that in South Africa it has been ascertained that the domestic cat will breed freely with the caffre cat. On the other hand, as we have already had occasion to mention, there are several species of Asiatic cats, such as the leopard-cat and the rusty-spotted cat, together with others referred to below, which will cross readily with the domestic cat of India. It is, however, quite possible that this may not affect the origin of the European cat, since Dr. Nehring is of opinion that the domestic cat of the Chinese has an exclusively Asiatic descent, and is thus quite distinct from that of Europe; while Mr. Blanford suggests an Indian origin for the domestic cats of that country.

Darwin considered that the origin of the domestic cat could not be determined with certainty; and concluded by remarking that whether domestic cats have descended from several distinct species, or have only been modified by occasional crosses, their fertility, so far as is known, is unimpaired.

That the ancient Egyptians had succeeded in taming thoroughly the cats of which the mummified bodies are found in such numbers at Bubastis and Beni-Hassan, is perfectly well ascertained. This is indeed demonstrated by a painting in

* This writer considers that there are two species of the Egyptian cat, *viz.*, *F. caffra* (or *maniculata*), and *F. caligata*.

the British Museum, representing a fowling scene. Commenting upon this picture, Mr. P. H. Gosse observes that it appears to have been the custom for the fowler to enter upon such expeditions accompanied by some of the female members of his family. "Embarking on board a boat, with a few decoy-birds and a trained cat, they proceeded to such parts of the river as were fringed with dense masses of the tall papyrus-reed. Waterfowl of various species swarmed in these rushy covers; and, by the number of nests with eggs and young usually represented, we are doubtless to infer that the possession of this sort of stock was no less desired than that of the birds themselves. The cat, strange as it appears, was certainly taught to seize upon the birds; in the picture before us she has just caught one in her mouth, while she holds another with her two fore-paws, and a third between her hind-paws. It is probable also that the repugnance of this animal to wet her feet having been



THE CAFFRE CAT.
(One-fifth natural size.)

overcome by training, she was accustomed to fetch such birds as fell into the water." In a footnote Mr. Gosse adds that it is "interesting to find the cat domesticated at so early a period. In the ochreous tints of the brindled fur, the two dark spots near the extremity of the tail, and a trace of the curved line upon the cheek, we think we recognize the *F. maniculata* [= *F. caffra*], to which modern naturalists have referred our domestic cat; though the Egyptian figure disagrees with Rüppel's in its more robust form and stouter legs." Professor Mivart speaks of the cat represented in the same painting as a "tabby cat," and would appear to regard it as belonging to a domesticated species or variety. The evidence of the mummified cats, which are indistinguishable from the wild caffre cat, points, however, strongly to the correctness of Professor Virchow's conclusion that the ordinary tamed cat of



W. Kuhnert.

WILD CAT.

the ancient Egyptians belonged to that species. Still, however, it is quite probable that certain variations from the original type may in some instances have been produced by breeding in a domesticated state.

THE WILD CAT (*Felis catus*)

The wild cat is the only native representative of the family found within the British Islands, where it is almost daily becoming scarcer.

In general color this species is not unlike many of our domestic "tabbies," from which it is distinguished, not only by its superior size and strength, but also by its stouter head, and the much shorter and thicker tail, which, instead of tapering, preserves a nearly uniform thickness to the tip. The ground color of the body is yellowish gray; the markings taking the form of a dark streak along the middle of the back, from which descends more or less nearly vertical stripes of the same hue, these stripes becoming nearly horizontal on the limbs, while the tail is ornamented with similar dark rings, and terminates in a black tip. The "whiskers" are more voluminous than in domestic cats; and in the male sex the soles of all the feet are black. The length of the tail is rather less than one-half that of the head and body. The male is considerably larger than the female, but shows a great amount of individual variation in its dimensions. According to the authors of Bell's *British Quadrupeds* the total average length of the males is about two feet nine inches, of which eleven inches is taken up by the tail; but an unusually large specimen killed near Cawdor Castle had a length of three feet nine inches from the nose to the tip of the tail.

The wild cat was formerly distributed over the forest-clad districts of the larger part of Great Britain, but, as we shall show later on, was never known in Ireland. It is widely distributed, in suitable localities over the Continent, occurring in France rarely, Germany commonly, Switzerland, Poland, Hungary, Southern Russia, Spain, Dalmatia, Greece, and parts of Turkey; but it is unknown in Italy, Norway, Sweden, and Northern Russia. The specimens from the more northern parts of its range are said to be larger, with longer and thicker fur, than those from its southern habitats. Eastward it has been recorded from the shores of the Caspian; and a large cat with a short tail killed by the late Sir O. B. St. John in Persia was referred by its captor to this species. The skin was, however, unfortunately lost, so that the determination cannot be regarded as absolutely certain.

The wild cat has been an inhabitant of Great Britain since the age of the mammoth; its fossil remains having been obtained (both there and on the Continent) in caverns containing the bones and teeth of the mammoth and other extinct Mammals of the Pleistocene age. It has, however, now completely disappeared from the greater part of England, only remaining in the mountainous districts of the north, its extermination from many of its former haunts being probably due not so much to the destruction of the forests, as to the increasing use of firearms. In parts of North Wales it appears to still linger, a specimen having been captured recently in that district, but there is considerable doubt as to whether it continues to breed

in the principality. In Scotland, although its distribution is now greatly restricted, the wild cat is not very uncommon in the more secluded localities.

Domestic cats that have escaped and taken to the woods are frequently mistaken for the wild cat; and it is owing to such errors in identification that, according to Dr. E. Hamilton, the supposed occurrence of the species in Ireland has been asserted.

Wild cats are expert climbers; and their favorite places of resort are the most inaccessible mountainous woods, where they retreat not only to hollow trees, or deep thickets, but to concealed fissures of rocks, in which they seek their safety and repose, and bring forth and rear their young. The female usually produces from four to five kittens in a litter; and instances are on record where these have been brought forth in the deserted or captured nests of some of the larger birds.

The fierceness and savage disposition of the wild cat, or "cat-a-mountain," as it was often called by the older writers, is proverbial, and displays itself even in the kittens, which will hiss and spit vigorously at all intruders on their lair. Several instances are related where wild cats have even attacked human beings. The destruction which they inflict on grouse, ptarmigan, rabbits, hares, fawns, and lambs, renders them detested alike by gamekeepers and shepherds, and has thus largely contributed to their reduced numbers in those parts of Britain where the species still survives. From the shortness and bushiness of its tail, there is good reason to believe that the wild cat is not the parent stock of our domestic cats. Still, however, there are undoubted instances where crossing has taken place between the two, such interbreeding having been frequently authenticated. On this point Jardine observes that "in the north of Scotland there has been occasional crossing with our native species, and the result of these crosses has been kept in our houses. I have seen many cats closely resembling the wild cat, and one or two that could scarcely be distinguished from it." Commenting on this statement, Blyth remarks that "such cats are never seen in the southern parts of England; still as compared with any Indian tame cat, the affinity of the ordinary British cat to *F. catus* is manifest, and is due, I suspect, to frequent intermixture at a time when the tame cat was first introduced into Britain, and continued rare, while the wild species was far more abundant than at present."

PALLAS'S CAT (*Felis manul*)

Apparently nearly allied to the European wild cat is a handsomely-colored species from the Siberian steppes, the Mongolian deserts, and the highlands of Tibet, known as the manul cat, or Pallas's cat. It is about the size of the ordinary domestic cat, with very long, thick, and soft fur, and a thick, bushy tail, of about half the length of the head and body. The head is remarkably broad, and the eyes are directed more forward than in any other species.

The general color of this cat varies from a silvery gray to a yellowish buff, becoming darker on the back, the chest being dark brown, while the under parts are lighter. The loins are marked by a few widely-separated transverse stripes, while the club-like tail has six or seven dark rings. Occasionally the limbs

may be slightly banded, while the front of the head is spotted, and the cheeks are marked by the usual pair of transverse streaks. The peculiar silvery "wash" on the fur is due to the circumstance that the ends of the longer hairs on the back are white, with short black tips.

In the steppes of Asia this cat takes the place of the wild cat of Europe. In the time of Pallas, its describer, its range extended from the southern flanks of the Urals through the Kirghiz, Turki, and Mongolian steppes to South Siberia, and from the foot of the Altai to Lake Baikal. Now, however, Pallas's cat appears to be unknown in the Orenburg steppes. Its food is said to consist largely of the small Rodents, commonly known as picas, or tailless hares (*Lagomys*). It is this cat which was regarded by Pallas as being the ancestral stock from which the domesticated Angora or Persian breed took origin, although the evidence in favor of this view is insufficient.

THE INDIAN DESERT-CAT (*Felis ornata*)

As implied by its name, the Indian desert-cat, like the species last mentioned, is an inhabitant of open regions, and in this respect differs widely from its spotted compatriot, the leopard-cat. The desert-cat is another of the numerous species agreeing approximately in size with average domestic cats, but it differs from the three preceding species in that the ornamentation of the fur takes the form of spots, which may have a tendency to arrange themselves in longitudinal lines along the body. Moreover, the tail, instead of being short and bushy, as in the two preceding species, is comparatively thin, tapering, and about equal in length to the head and body. The general ground color of the desert-cat is pale sandy, or "isabelline"; the spots on the body are small and rounded, while those on the neck and head are still smaller, elongated, and tend to form lines. The outer surfaces of the limbs have dark bars, and the upper surface of the base of the tail is similarly barred, while near the end the tail is ringed, and its tip is black. The soles of the feet are also black below. This little cat is confined to the desert and sandy regions of Western India, being especially common in the deserts to the east of the Indus, in Sind, Western Rajputana, and Hurriana, where, according to Mr. Blanford, it subsists largely on the gerbils which abound in such regions. The spotted sandy fur of this cat probably harmonizes well in color with the desert sands dotted here and there with darker pebbles.

In the deserts of Eastern Turkestan, in the neighborhood of Yarkand and Kashgar, this cat is replaced by the nearly-allied Shaw's cat (*F. shawiana*), distinguished by its rather larger size and shorter tail.

Nearly related to the desert-cat is the far less common waved cat (*F. torquata*) from Northern India, Kashmir, Nipal, etc. This species is distinguished by its more uniform coloration of ashy gray, becoming more or less rufous in some specimens, and passing into buff on the lower parts. The head and back are marked by indistinct longitudinal dark bands, and there are also numerous rows of incomplete vertical stripes, passing into spots on the sides of the body. The under parts are plain colored, but the tail and feet are marked as in the desert-cat, the under surface of the latter being, however, brown instead of black.

The desert and waved cats have a particular interest in relation to the origin of the domestic cats of India, since it appears that the former interbreeds with domestic cats, many of which, in the regions inhabited by the desert-cat, are spotted in a nearly similar manner. In regard to the waved cat, Mr. Blanford remarks that "nothing especial is known of the habits, and it is far from improbable that specimens of the present form are merely descendants of tame cats that have run wild. The converse is, however, equally probable, that this is the aboriginal race from which Indian domestic cats, and possibly those from other countries, are derived; and the circumstance that skins from parts of India so distant from each other as Nipal, Rajputana, and Kashmir, are precisely similar, is in favor of the latter view."

DOMESTIC CATS

In the course of our survey of the last few species it has been incidentally mentioned that the domestic cats of various countries interbreed with, and more or less closely resemble in coloration, some of the species of wild cats inhabiting the same districts. It has also been mentioned that the ancient Egyptians were in the habit of taming and training the wild caffre cat of their own country, which has been regarded by many authorities as the ancestral stock from which were derived the domesticated cats of Europe.

Without committing ourselves definitely to any one view, we confess that we are inclined to follow those who consider the caffre cat as the original parent stock of the domesticated breeds of Europe, but that, as suggested by Mr. Blyth, there has probably been at least in many districts, a large amount of subsequent crossing of the original domestic breed with the wild cat. We are further disposed to believe that the domesticated cats of India may have had a totally independent origin from those of Europe, and we would also incline to the view that either the desert-cat or the waved cat (if the latter be a truly wild species) may have been the original parent stock from which they were derived. The common occurrence of spotted domestic cats in India—such being comparatively rare in Europe—is, indeed, highly suggestive of an origin from one or more of the numerous spotted wild species now inhabiting that country, while the general prevalence of "tabbies" in Europe is in favor of their origin from the caffre cat, with more or less intercrossing with the wild cat. It is, of course, possible that the prevalence of spotted domestic cats in India may be solely due to the effects of crossing with their wild compatriots, but the former is certainly the most natural view. Without going into the question of the origin of the domestic cats of other regions, we think, then, that, on the whole, the evidence shows that all those of Europe and Asia have not been derived from one single parent stock.

Having said thus much as to the probable origin of domestic cats, we pass on to consider briefly some of the most important and well marked of their breeds. Before doing so we may, however, quote with advantage a passage from the writings of Professor Mivart, pointing out the services which the cat confers on the human race. "The domestic cat," observes this writer, "is an animal so common and

familiar that its utility is sometimes apt to be lost sight of. To realize its usefulness we must imagine ourselves in a land where no such animal is known, but where the annoying creatures upon which it preys shall have multiplied with that rapidity natural to them. The familiar tale of Whittington may serve to illustrate what would be the effect of its introduction into such a land. It has been calculated that a single cat may devour twenty mice in one day ; but this, of course, is by no means the limit of its powers of destruction. Its effect in putting to flight the creatures it pursues is, again, far in excess of its destructive energy. Were every cat in Eng-



THE DOMESTIC CAT.
(One-sixth natural size.)

land simultaneously destroyed, the loss through the entailed increase of vermin would be enormous."

On account of these invaluable qualities the domestic cat has been introduced into almost every country in the world. There is, however, still some degree of uncertainty as to the period when domesticated cats were first known in Europe, although they were undoubtedly in existence there previously to the Christian era. The Mammal used by the ancient Greeks for the purpose for which we employ the cat, and called by them *ailuros*, was long considered to be the same as the

modern cat. The late Professor Rolleston, of Oxford, brought forward, however, a considerable amount of evidence to show that the *ailuros* of the Greeks was really a marten, and this view receives some support from the fact that no remains of cats have been discovered among the ashes of Pompeii and Herculaneum. That cats continued to be comparatively scarce and valuable animals during the middle ages, is proved by the laws made in several countries for their special protection, and the fines imposed on those who injured or killed them.

Coming now to the consideration of the various kinds of domestic cats, it may be observed, in the first place, that the different breeds of these animals are distinguished from one another mainly or entirely by such characteristics as color, length of hair, or more rarely, length of tail; and that they do not present the marked structural differences distinguishing the various breeds of dogs. This general similarity may be partly accounted for by the circumstance that all cats are required for much the same purpose, so that there has been no special inducement for breeders to modify the structure of the creature. A more important factor in the case is, however, in our opinion, the greater specialization of a cat as compared with a dog, as is particularly shown in the shortness of the face, the diminution in the number of the teeth, and the peculiar structure of the cheek-teeth, it being sufficiently obvious that a short-faced and few-toothed animal is not capable of those modifications in the length and proportions of the skull, which can be so readily induced in creatures with longer muzzles and a greater number of teeth. That cats are, however, capable of perpetuating for a longer or shorter period structural modifications, is proved by a race of these animals with six toes on each foot, in which the peculiarity was inherited to the tenth generation.

As regards coloration, European cats are commonly either "tabby," black, white, sandy, tortoise shell, dun, gray, or the so-called "blue"; the two latter colors being more rare than the others. All these different varieties will generally breed more or less nearly true if prevented from crossing, but it frequently happens that litters will contain different-colored kittens. Formerly the ordinary European cats were short and smooth-haired animals, but of late years there has been a large amount of crossing with the Persian breed, which has resulted in the production of a number of long-haired cats. The true-bred "tabby" cat was, perhaps, the most common English variety, its well-marked vertical stripes being not improbably due to an original crossing with the wild cat. Its proper ground color is gray, marked with a black stripe down the back, and having subconcentric bands of the same color on the sides and limbs. The rare gray cats may be regarded as tabbies which have lost all their stripes, with the exception of two transverse bars on the fore-legs. Black cats may probably be considered analogous to black leopards, since, even when purely bred, young kittens of this color almost invariably show the stripes of the "tabby." Usually black cats have some white hairs, more especially on the throat, and it is almost needless to remark, by an ever-increasing mixture of white, a perfect transition may exist from black to white cats, the same holding good with regard to the other breeds. In pure-bred black cats the eyes are of a clear yellow. In white cats, on the other hand, the eyes may be either of the ordinary greenish-yellow tinge, or of a pure blue, while in some cases one eye may be blue and the

other yellow, this feature being especially admired in white Persian cats. As is now well known, white cats, with blue eyes are usually deaf, this deafness being probably attributable to the lack of dark pigment characterizing the eyes also extending to the ears; such dark pigment being, in some mysterious manner, connected with the sense of hearing.

The pure-bred tortoise-shell cat — a race which, by the way, seems now much more rare in England than formerly — should be of an orange-fawn color, irregularly blotched with black, without any mixture of white. Such cats are almost invariably females, although according to Professor Mivart, there is at least one good instance of a pure “tortoise-shell tom.” The male of this breed is the sandy cat, and the writer above mentioned comments upon the extreme peculiarity in this difference



THE ANGORA CAT.
(One-seventh natural size.)

of the coloration in the two sexes of this breed, the males and females of all wild cats, with the single exception of the South American jaguarondi (in which the female is the brighter of the two), being colored alike. Occasionally, however, female sandy cats are to be met with, while sandy-and-white and tortoise-shell-and-white cats may be of either sex. The so-called “blue” or Carthusian cat is characterized by its long and silky hair being of a uniform grayish-blue color, while the lips and the soles of the feet are black.

Turning to Asiatic cats, it has already been mentioned that many of those of India have more or less distinctly spotted coats like their wild compatriots, such coloration being almost unknown in Europe. The most celebrated of all the Asiatic

breeds is the Persian, or Angora cat, its second title being derived from a town in Asia Minor. These cats are characterized by their large size, their long silky hair, —most developed on the throat and under parts,—and the thick, bushy tail. The color is generally uniform, varying from pure white to a yellowish or grayish tint, while the lips and the soles of the feet are not uncommonly flesh colored. The occurrence of individuals with one blue and one yellow eye in this breed has been already mentioned, while allusion has likewise been made to the opinion that the Persian cat is descended from Pallas's cat of the Asiatic steppes. It was said some years ago that the breed of these cats in Angora had been greatly reduced in numbers, owing to their skins having been in large demand as furs.

In Siam there is a breed of cats reserved for royalty, characterized by their uniform, and often dark, fawn color, their blue eyes, and the presence of two or more perfectly bald spots on the forehead. Siam, together with Burma, also possesses a breed known as the Malay cat, in which the tail is but half the usual length, and is often, through deformity in its bones, tightly curled up into a knot. These short-tailed Asiatic cats lead to the mention of the tailless cats of the Isle of Man, in which the tail is either reduced to a mere stump, or almost wanting. Owing, however, probably to the introduction of ordinary cats from the mainland, cats in the Isle of Man are now to be met with having tails of all lengths up to ten inches. Tailless cats, according to Professor Mivart, also exist in the Crimea, while they have been recorded by Kämpfer from Japan.

The other domestic breeds to which we shall refer include the Mombas cat from the eastern coast of Africa, said to be distinguished by its stiff and wiry hair, and the Paraguay cat of South America, which is much smaller than ordinary cats, with a long body, covered with close-lying short and scanty hair. The description of the latter is suggestive of some affinity with the eyra of the same regions.

Like many of the smaller wild species, the domestic cat has the pupil of the eye reduced to a narrow vertical slit when at its smallest dimensions. It also agrees with its wild cousins in the extremely small development of the sense of smell, depending chiefly upon sight and the exquisite sense of perception residing in the so-called "whiskers." The effects of domestication have, however, considerably increased the reproductive powers of the cat, the tame races having young three or four times during the year, and producing from five or six to eight or nine kittens at a birth.

With regard to its intelligence, Dr. Romanes observes that "the cat is unquestionably a highly intelligent animal, though, when contrasted with its great domestic rival the dog, its intelligence, from being cast in quite a different mold, is very frequently underrated. Comparatively unsocial in temperament, wandringly predacious in habits, and lacking in the affectionate docility of the canine nature, this animal has never in any considerable degree been subject to the psychological transforming influences whereby a prolonged and intimate association with man has so profoundly modified the psychology of the dog. Nevertheless, the cat is not only by nature an animal remarkable for intelligence, but, in spite of its naturally imposed disadvantage of temperament, has not altogether escaped those privileges of nurture, which unnumbered centuries of domestication could scarcely fail to supply.

Thus, as contrasted with most of the wild species of the genus when tamed from their youngest days, the domestic cat is conspicuously of less uncertain temper toward its master — the uncertainty of temper displayed by nearly all the wild members of the feline tribe when tamed being, of course, an expression of the interference of individual with hereditary experience. And, as contrasted with all the wild species of the genus when tamed, the domestic cat is conspicuous in alone manifesting any exalted development of affection towards the human kind; for in many individual cases such affection, under favoring circumstances, reaches a level fully comparable to that which it attains in the dog."

The writer then proceeds to observe that the most obvious trait in the "emotional" character of the cat is its strongly-rooted attachment to places as distinguished from persons, and it is considered that this is probably inherited from an instinctive attachment to their lairs, characteristic of its wild ancestors. The second feature in this aspect of the cat's nature is its partiality for torturing its helpless prey — a trait which Dr. Romanes ascribes to the delight of torturing for torture's sake.

As regards their higher faculties, the same author observes that "it is to be noted as a general feature of interest that all cats, however domesticated they may be, when circumstances require it, and often even quite spontaneously, throw off with the utmost ease the whole mental clothing of their artificial experience, and return in naked simplicity to the natural habits of their ancestors. This readiness of cats to become feral is a strong expression of the shallow psychological influence which prolonged domestication has here exerted, in comparison with that which it has produced in the case of the dog. A pet terrier lost in the haunts of its ancestors is almost as pitiable an object as a babe in the wood; a pet cat under similar circumstances soon finds itself quite at home. The reason of this difference is, of course, that the psychology of the cat, never having lent itself to the practical uses of and intelligent dependency on man, has never, as in the case of the dog, been under the culminative influence of human agency in becoming further and further bent away from its original and naturally imposed position of self-reliance, so that, when a severance takes place between a cat and its human protectors, the animal, inheriting unimpaired the transmitted intelligence of wild progenitors, knows very well how to take care of itself."

The terrible pests that domestic cats which indulge either in nocturnal poaching expeditions, or which have taken to a completely wild life in the woods, become, is known to all who have anything to do with rabbit warrens or game preserves. In the island of St. Helena, Darwin tells up that a few cats which had been originally turned loose, in order to destroy the rats and mice, increased in numbers so as to become a perfect plague. And the same observer mentions that in some parts of South America the domestic cats which had run wild had become modified into larger creatures of exceeding fierceness, inhabiting rocky hills.

THE PAMPAS CAT (*Felis pajeros*)

With the pampas cat, also known as the straw-cat or the grass-cat, we come to the last of the South American cats, and also the only one absolutely confined to the barren regions of Argentina and Patagonia, ranging to the extreme southern limits of the latter country. From dwelling in such desert regions, the pampas cat may, as Professor Mivart remarks, well be regarded as the New World representative of Pallas's cat of the steppes of Central Asia.



THE PAMPAS CAT.
(One-sixth natural size.)

This species is described as being of about the same size as the European wild cat, but of stouter build, with a smaller head and a still shorter tail. The fur is long and of a yellowish-gray ground color, marked with brownish or straw-colored bands, running obliquely from the back across the flanks, the tail and legs being barred with similar bands. From the eyes two dark patches are continued downward to meet on the throat. As usual, the under part of the body is whitish. The total length of the animal is given as three feet one inch, of which twelve inches are occupied by the tail. The skull is remarkable for its extreme shortness, and likewise for the presence of only two premolar teeth in the upper jaw.

This cat may be regarded as one of the most distinctive animals of the pampas. Mr. W. H. Hudson speaks of it as not unlike *F. catus* in its robust form and dark color, but a larger, more powerful animal, inexpressibly savage in disposition.

THE JUNGLE-CAT (*Felis chaus*)

The common Indian jungle-cat is an important member of the family, since it serves to connect the more typical cats so closely with the lynxes as to render it impossible to refer the latter (as has been often proposed) to a distinct genus.

The jungle-cat is somewhat superior in size to the ordinary domestic cat, from which it differs in having a circular pupil to the eye, thereby agreeing with the lynxes. It also approximates to the latter in having a few long hairs on the tips of



THE JUNGLE-CAT.
(One-sixth natural size.)

the ears, although these are not sufficiently numerous to form distinct tufts. The tail is, moreover, less elongated than in many of the true cats, varying from one-third to two-fifths the length of the head and body. In the presence of three premolar teeth in the upper jaw, as well as in the form of the lower flesh-tooth, the jungle-cat agrees, however, with the more typical representatives of the family, as distinct from the lynxes.

The color of the fur of the body varies from sandy or yellowish gray to grayish brown, the back being darker, with a tendency to reddish in some individuals or to

a dusky tint in others, while the under parts are whitish, with a yellow or red tinge. The individual hairs, which vary in length according to the locality whence the animals come, are not of uniform color throughout their length, the upper ends being generally grayish white, with black tips. Usually fully-adult animals are uniformly colored, but the limbs may be marked with dusky transverse bars, while, more rarely, rows of indistinct spots or wavy lines may be detected. The inner side of the upper part of the fore-limb usually has the two broad transverse bars common to so many cats. The cheeks and breast may be either banded or pale, while the tail is ringed, and its tip, like those of the ears, black. The soles of the feet are of a dusky-brown color. The total length of the animal varies from thirty-three to thirty-nine inches, the length of the tail (with the hair) in the smaller form being eleven inches.

Although the jungle-cat may be regarded as a characteristic animal of India, where it is found from Cape Comorin to elevations of about eight thousand feet in the Himalayas, and also occurs in Ceylon and Burma, yet it has a wide range to the westward, being common in Persia, and thence extending through Syria to North Africa. Occasionally black specimens of this cat are met with in India.

The jungle-cat, although, from its nocturnal habits, rarely seen, is described by the late Dr. Jerdon as frequenting "alike jungles and the open country, and is very partial to long grass and reeds, sugar cane fields, cornfields, etc. It does much damage to game of all kinds,—hares, partridges, etc.,—and once I shot a peafowl at the edge of a sugar cane field, when one of these cats sprang out, seized the peafowl, and, after a short struggle (for the bird was not dead), carried it off before my astonished eyes, and, in spite of my running up, made good his escape with his booty." It is said to be very destructive at times to poultry. The present writer once came suddenly upon the jungle-cat in the outer Himalayas on the edge of a recently-cut field of maize, which, after staring in astonishment for a few seconds, quietly made its way into cover.

In disposition the jungle-cat is described as being very savage; and, even when caught young, is generally untamable. It is said to breed twice a year (like the European wild cat), and to produce three or four kittens at a birth, which, when captured are very difficult to rear. The late Sir. O. B. St. John, as quoted by Mr. Blanford, when writing of his Persian experiences, states that among the mountains of the South he found three kittens of this species so young as to be unable to drink milk. "I reared them," continues this observer, "with some difficulty, till about three months old, by which time they became very tame and playful, climbing up on my knees when at breakfast, and behaving very much like ordinary domestic kittens. Unfortunately one was killed by a greyhound, and another by a scorpion, within a few days, on which the survivor became morose, and refused to be comforted, even by the society of a kitten of his own age, which I procured as a companion to him. When I left Persia in 1867, he was a year old, and very large and powerful. Two English bull terriers I had, who made short work of the largest domestic cat, could do nothing with my wild cat. In their almost daily battles the dogs always got the worst of it."



CARACALS HUNTING.

THE CARACAL (*Felis caracal*)

The foxy-colored cat known as the caracal is a species of larger size than the jungle-cat, though smaller than the true lynx, and agrees with the latter in its long limbs, penciled ears, and the characteristics of its teeth; but in its longer tail, absence of a ruff round the throat, and less close and thick fur, it resembles the jungle-cat. The transition from the typical cats to the lynxes is, therefore, complete.

The caracal, in addition to its relatively long limbs, is characterized by its slender build, by the length of the tail being equal to one-third of that of the hind-leg and body, and by the long tufts of black hair surmounting the long ears. From the latter feature the animal is known to the Persians by the name of *Siyah-gush*; *siyah* signifying black and *gush* ears. The skull is characterized by the elevation of the crown and the shortness of the face; while there are but two premolar teeth in the upper jaw, and the flesh-tooth of the lower jaw is distinguished by the presence of the rudiment of the heel, which is found fully developed in that of the hyænas.

In color the caracal varies from a uniform rufous-fawn color to a brownish rufous; the under parts being either a paler rufous or white, and frequently marked with obscure rufous spots. The limbs and tail are colored like the body, although in some individuals the tip of the tail may be black. The outer sides of the ears are either partially or completely black, while their interiors are white. The length of the head and body varies from twenty-six to thirty inches, and that of the tail from nine to ten inches; the height at the shoulder being from sixteen to eighteen inches.

This species is sometimes known as the Persian, and at others as the red lynx, but the latter name is properly applied to a North American variety of the true lynx. Although a rare animal everywhere, the caracal is spread over the greater part of India, with the exception of Bengal, the Malabar coast, and the Eastern Himalayas. It is unknown to the eastward of the Bay of Bengal, but towards the southwest it is found in Mesopotamia, and perhaps the Persian highlands. It is also found in Arabia; and over a large portion of Africa it is the sole representative of the lynxes.

We have little or no information as to the habits of the caracal in Africa, and only a scant record of its mode of life in India. Mr. Blanford considers, however, that it probably dwells among grass and bushes, rather than in forests. Its prey is stated to consist largely of gazelles, the smaller species of deer, hares, peafowl, florican, cranes, and other birds; and so active is the creature, that it is asserted to have the power of springing up and capturing birds on the wing at a height of five or six feet above the ground. The caracal is easily tamed, and in some parts of India is trained to capture several of the animals mentioned above as forming its natural prey. Blyth records that it is a favorite amusement among the natives to let loose a couple of tame caracals among a flock of pigeons feeding on the ground, when each of them will strike down as many as ten birds before the flock can escape. It is believed that the expression "lynx-eyed" owes its origin to this species.

THE LYNX (*Felis lynx*)

Few animals have given rise to more discussion among zoologists, in regard to the number of species into which they should be divided, than the true lynxes; some authorities regarding those found in North America as representing three species quite distinct from the typical Old World lynx, while others are disposed to consider the whole four as mere varieties of a single species. It was likewise at one time considered that there were two Old World lynxes occurring to the north of the



THE NORTHERN LYNX.
(One-eighth natural size.)

Alps; one being the common lynx of Europe, and the other the Tibetan lynx. It has now, however, been shown that these two varieties pass imperceptibly into each other; but to the south of the Alps, the so-called pardine lynx is regarded as probably a distinct species. Without committing ourselves definitely to any one view, we shall treat of the whole of these various forms of lynxes, with the exception of the pardine lynx, under a single heading.

The true lynxes are mainly a northern group, being unknown in Africa, India, and South America. They are very characteristic of North America, where,

to the northward of the Rio Grande, they are, with the exception of the puma, the sole representatives of the Cat family. Their range in the New World extends further to the southward than in the Old World, as it there reaches to Southern California and the Rio Grande.

The whole of the true lynxes, whether we regard them as species or varieties, agree with the caracal in the form of the skull, the number and structure of the teeth, the black tufts to the ears, and the relatively-long legs. They differ however, by their stouter build, by the ruff of long hair fringing the throat, and the shorter tail, which is less than one-fourth the length of the head and body. They are further characterized by the softness and thickness of their beautiful fur, which is frequently marked with spots, and is highly valued by furriers.

Commencing with the true northern lynx of the Old World, we
Northern Lynx find that the color of its fur varies from a pale sandy gray, or isabelline tint, to a rufous fawn washed with gray; some European skins being ferruginous red. The under parts of the body are white. Although there is a great amount of local variation with regard to the presence of spots on the winter coat, it appears from the researches of Mr. Blanford that in the summer dress the fur of the body is always marked with small black spots. In some instances, perhaps in young animals only, these spots continue during the winter. This, however, appears to occur only among the lynxes of Europe; those of Asia having the winter dress without spots, except on the flanks and limbs, while they may be also wanting there. The hairs of the fur vary in color in different parts of their length, and are tipped with black. The ears are gray on the outsides, with black margins, tips, and tufts. Occasionally the under parts of the body are spotted. The length of a full-grown lynx, according to Mr. Blanford, is thirty-three inches exclusive of the tail, which measures only seven and three-fourths inches; but Professor Mivart says that the length of the head and body may be upwards of forty inches.

The lynx now inhabits the northern districts of Sweden, Norway, and Russia; but appears to have been exterminated from the forest districts of Central Europe, where it was formerly common. A lynx was, however, killed in the Haute Loire, France, in the year 1822, and a second in Württemberg in 1846. Eastward the lynx extends through the greater part of Asia, north of the Himalayas, ranging through Tibet into Ladakh, and occurring in the upper Indus valley as far westward as Gilgit.

In Europe the lynx is a forest-dwelling animal, being an expert climber, and often found in trees. The lynx of Tibet, distinguished by Blyth as the isabelline lynx (*F. isabellina*), is, however, an inhabitant of a barren country, and dwells in open ground among rocky districts. It is of a paler color than the European variety, with shorter hair on the soles of its feet. This difference of coloration is, however, as pointed out by Mr. Blanford, doubtless due to the difference of its surroundings; this being confirmed in a remarkable manner by the lynx found in the Gilgit district, where a certain amount of forest occurs, which is intermediate in coloration between the European and Tibetan varieties. The Turkestan lynx resembles the one from Gilgit.

In Europe the lynx used to be found at low elevations, in Gilgit it occurs at elevations of about five thousand feet, while in Tibet it is not found below some fourteen to fifteen thousand feet in summer. The food of the lynx varies according to its habitat. In Europe it preys upon birds and upon Mammals varying in size from mice to goats and sheep, and perhaps occasionally larger species. In disposition it is extremely savage, and will often kill more animals than it can devour ;



THE EUROPEAN LYNX.
(One-tenth natural size.)

Dr. Scully mentioning that in Gilgit a pair of lynxes killed six sheep in a single night. From two to three cubs are produced at a birth ; the lair being usually formed among rocks. The young are born blind.

When taken young, the lynx can be easily tamed. The writer saw a full-grown tame Tibetan lynx in the possession of the late Mr. W. H. Johnson, then governor of Ladakh, in Leh, during the year 1874, and another in Calcutta in 1878,

belonging to Dr. J. Anderson. Both specimens were very playful, although the former would occasionally be somewhat too free with its claws. It displayed marvellous agility in capturing the half-wild pigeons which abound in Leh.

In Ladakh, where the lynx is a rare animal, but seldom seen by Europeans, its chief food appears to consist of the blue hares which occur in swarms in many of the higher valleys. General Kinloch writes that in the summer of 1866, when shooting at a high elevation near Hanle, in Spiti, "I suddenly came upon a female lynx with two cubs. I shot the mother, and as the cubs concealed themselves among some rocks, I barricaded them in, and went on with my hunting. On arriving in camp, I sent back men to try and catch the cubs; in this they succeeded, and brought them back to me. They were about the size of half-grown cats, and more spiteful, vicious little devils cannot be imagined; they were, however, very handsome, with immense heads and paws. For two or three days they refused all food, but at the end of that time they fed quite ravenously from the hand. They soon became very tame and playful, although always ready to set their backs up if at all teased, or if a dog came near them."

Coming to the American species or varieties of lynxes, the first and **Canada Lynx** largest is the Canada lynx (*F. canadensis*). Professor Mivart describes this as very like the European form, the specimens that came under his notice being smaller, and not exceeding thirty inches in length from the muzzle to the root of the tail, with a tail five inches long; but Mr. C. J. Nattrass says that the Canada lynx may exceed three feet in length. The same writer observes that in some climates the color of this lynx is almost white, although usually of a dark gray tinged with chestnut, with the limbs darker than the body. The back and the upper part of the legs are mottled with darker blotches, and the tips of the hairs are white.

The Canada lynx extends from Canada at least as far south as the Adirondack mountains, near New York; and is the *loup cervier* of the French Canadians. In the Adirondacks, where it is nowhere common, it preys, according to Dr. Hart Merriam, "upon the northern hare, and such other small Mammals as it can catch, and upon the ruffed grouse and spruce partridge. It has also been known to devour pigs, lambs, and young fawns; but the accounts of it attacking full-grown deer are not to be credited. Its haunts are in the deep forests and bush districts, remote from the paths of man; and consequently it rarely intrudes upon the barnyard. Its ordinary gait when in a hurry is a long gallop, like that of the hare, and it is said to swim well. The female commonly has two young at a birth, her lair being usually located in a cavern or hollow tree."

Mr. Nattrass states that this lynx when leaping over the ground, as it does in a series of successive bounds, with back arched, the tail so short as to be almost indiscernible, presents altogether a quaint, weird appearance, which has been described by many hunters and backwoodsmen as laughable and peculiar in the extreme. The same writer also relates an instance where a lynx, when hard pressed by dogs, took to the water and swam right across Lake Lemán, of which the width is almost a mile. He likewise states that the lynx will feast upon the forsaken prey of the puma, which may account for the legends of its killing the larger kinds of deer;

smaller deer fall, however, frequent victims to the lynx. Mr. Nattrass records a crossbreed between the lynx and the domestic cat.

"The lynx," he says, "is seldom hunted systematically, as are the deer, elk, bear, and other game animals, unless it is by professional hunters or trappers, who value him for his pelt. With them the usual method is to hunt him with dogs trained to follow the trail by scent. In other cases his track is followed through the snow, by the eye, by a party of hunters, who, when starting out, must be prepared to make a long, hard tramp of many hours, or possibly several days. I have known a party, who wanted a lynx badly, to follow the trail of one all day, returning home as darkness set in. They returned to the hunt next morning, took up the trail where they left it the night before, and followed it all day, and again the next day, till they finally trailed the beast to its lair, treed, and shot it."

The next form of the American lynxes is known indifferently as the **Bay Lynx** bay lynx, red cat, or American wild cat, and is the *chat cervier* of the French Canadians, and the *F. rufa* of those zoologists who regard it entitled to rank as a distinct species. In the typical form the fur is shorter and less abundant than that of the Canada lynx, and is of a uniform reddish color, while the tail appears to be more bushy. Its size is also somewhat inferior to that of the last-named kind. There is, however, a handsomer spotted variety of the bay lynx occurring in Texas and Southern California, which was formerly regarded as a distinct species (*F. maculata*); and a second from Washington and Oregon, distinguished by vertical dark streaks on the body, this variety having been named (*F. fasciata*). Both these are, however, now generally regarded as mere geographical races of the bay lynx.

In the Adirondacks the bay lynx is very rare, probably on account of the climate being too severe for it, as it is far more common to the southward. "It frequents rocky hills and ledges," writes Dr. Merriam, "and does not show that antipathy to civilization so marked in its congener the [Canadian] lynx. In fact, it is often quite common in thickly-settled portions of the state, and sometimes proves of much annoyance to the farmer by carrying off lambs, little pigs, and poultry,—ducks, geese, turkeys, and chickens proving equally acceptable. Away from the farmyard it feeds upon rabbits, squirrels, mice, grouse, and what small birds it is fortunate enough to capture. It generally makes its nest in a hollow tree or log, and lines it well with moss. From two to four young constitute a litter, the most frequent number being three." Dr. Merriam mentions the extremely spiteful disposition of the bay lynx, and adds, "I have eaten the flesh of the wild cat, and can pronounce it excellent. It is white, very tender, and suggests veal more than any other meat with which I am familiar."

The last of the American lynxes which the transatlantic naturalists now regard as a distinct species, is the plateau lynx (*F. baileyi*). This form takes its name from inhabiting the high plateau of Colorado, Utah, and Arizona; and is said to differ from the bay lynx in being uniformly paler above, and also by its shorter tail and softer fur. The back is suffused with a buff tint, and the blackish marblings found on the face and forehead of the bay lynx are wanting, while the black at the tip of the tail occupies a smaller area than in the latter. There is also some differ-

ence with regard to the coloration of the ear ; and the hind toes lack the white color which they possess in the bay lynx.

THE PARDINE LYNX (*Felis pardina*)

The pardine or Southern European lynx is, perhaps, the handsomest representative of the entire group, its fur being distinctly spotted at all seasons of the year. The color of the body is rufous above, and white beneath ; the rounded black spots occurring on the body, tail and limbs. From the examination of the skin alone, Professor Mivart says that he was disposed to regard this animal merely as a southern spotted variety of the common lynx, analogous to the spotted and banded



THE PARDINE LYNX.
(One-eighth natural size.)

southern varieties of the American bay lynx. An examination of the skull showed, however, such differences from that of the northern lynx as to lead to the conclusion that the pardine lynx was in all probability a distinct species.

This lynx is found in Europe in Spain, Sicily, Sardinia, Greece, and Turkey. Its habits are probably very similar to those of the northern species.

Fossil remains of the pardine lynx have been found in the caves of Gibraltar in company with those of the serval ; and it thus becomes a curious subject for consideration why the former is now restricted to Europe, and the latter to Africa. Remains referred to the common lynx have been discovered in the caves of England and the Continent.

THE HUNTING-LEOPARD (*Cynælurus jubatus*)

The hunting-leopard (unless, as some writers think, there be two species) is the last representative of the Cat family, and differs so markedly in certain respects from all the others that it is now generally admitted to rank as a distinct genus. As already mentioned, it is generally known to Europeans as the chita (or cheetah);



THE HUNTING-LEOPARD.
(One-ninth natural size.)

but since this name is at least equally applicable to the true leopard, its use is better avoided.

The points on which zoologists chiefly rely in making the hunting-leopard the representative of a separate genus are twofold. Firstly, and most important, the claws can only be partially withdrawn into their protecting sheaths, so that they always remain partly exposed. Secondly, the upper flesh-tooth consists simply of a trenchant blade, without the distinct lobe found on its inner side in the true cats

and hyænas.* While, therefore, the hunting-leopard is a more generalized animal than the true cats in regard to its feet, the characteristics of its upper flesh-tooth indicate greater specialization, this inner lobe occurring in all the more primitive types of Carnivores.

The hunting-leopard is distinguished by the slenderness of its body, and the great relative length of its limbs, which are longer than in any of the true cats, not even excepting the lynxes. In length of body it may be compared with the true leopard, although it stands much higher on the legs. The pupil of the eye is round, the ears are small and rounded, and the fur is rather coarse, and more or less lengthened on the neck and the under parts of the body. The tail is relatively long, being equal to more than half the length of the head and body. The skull is characterized by the extreme elevation of the crown, as well as by the shortness of its facial portion; in both of which respects it resembles that of the snow-leopard. The first of the three upper premolar teeth is unusually small.

In color the fur of the hunting-leopard varies from tawny to a bright rufous-fawn tint, becoming paler on the under parts. On this ground color black spots are distributed over almost the whole of the animal, with the exception of the buff-colored chin and throat; these spots being round, without any light-colored centres, and not arranged either in rosettes or in lines. The head is marked by one black stripe running from the front corner of the eye to the upper lip, and sometimes by another from the hinder part of the eye to the ear. The ears are black on the outer surface, but tawny on the margins and at the base. On the tail the spots are confined to the upper surface, but toward the tip they tend to form incomplete rings. Such is the coloration of the adult of this animal. In the young cubs, however, the fur is very long—especially on the back—and of a uniform gray tint, without any trace of spots; but it is stated, that if a cub in this state be clipped, the under fur will exhibit distinct spotting. According to measurements given by Jerdon, an adult hunting-leopard has a total length of about seven feet, of which two and one-half feet are occupied by the tail; the height at the shoulder varies from two and one-half to two and three-fourths feet.

This animal is one of the few members of the family common to all Africa and India; its range extending from Africa through Syria, Mesopotamia, and Persia. It is not found in Bengal, nor on the Malabar coast, nor to the northward of the Ganges. It is also said to be unknown in Ceylon; and, like all the cats common to Africa and India, with the exception of the leopard, does not occur to the east of the Bay of Bengal. Some years ago Mr. Selater described a hunting-leopard from South Africa which differed from the ordinary form by its stouter build, thicker tail, and more dense and woolly fur, the longest hairs occurring on the neck, ears, and tail. The spots were also much paler, and the lines between the eyes and the mouth absent. This "woolly hunting-leopard" was regarded by its describer as a distinct species (*C. lanius*), but several later writers have been indisposed to admit it to this rank.

We have but little information as to the distribution of the hunting-leopard in Africa. The Hon. W. H. Drummond states, on the authority of the natives, that

* This lobe is shown in the figure of the upper flesh-tooth of a hyæna on p. 356.

in Southeast Africa it is very rare, although found more commonly than elsewhere in the rocky gorges of the Bombo mountains, where it lies concealed in the dense jungle, from which it occasionally ventures forth on the open plains. Its chief prey consists of various species of antelopes. It is regarded as perfectly harmless, and indeed cowardly, towards man. Both Mr. Drummond and his native hunters appear to have often mistaken hunting-leopards for immature lionesses when seen at a little distance on the sandy plains. To the natives of Southeast Africa the animal is known as the N'Gulule.

In India our information with regard to hunting-leopards is much fuller, owing to their being kept by many of the native princes for the purpose of sport, which entails the necessity of careful observation of their haunts and habits on the part of those intrusted with their training; and this more particularly as only full-grown examples are captured, the belief among the natives of India being that when captured as cubs they are of no use for sporting purposes.

According to Mr. Blanford, the principal haunt of the Indian hunting-leopard "is in low, isolated, rocky hills, near the plains on which live antelopes, its principal prey. It also kills gazelles, nilgai, and, doubtless, occasionally deer and other animals. Instances also occur of sheep and goats being carried off by it, but it rarely molests domestic animals, and has not been known to attack men. Its mode of capturing its prey is to stalk up to within a moderate distance of from one to two hundred yards, taking advantage of inequalities of the ground, bushes, or other cover, and then to make a rush. Its speed for a short distance is remarkable—far exceeding that of any other beast of prey, even of a greyhound or kangaroo-hound, for no dog can at first overtake an Indian antelope or a gazelle, either of which is quickly run down by *C. jubatus*, if the start does not exceed about two hundred yards. General M'Master saw a very fine hunting-leopard catch a black buck that had about that start within four hundred yards. It is probable that for a short distance the hunting-leopard is the swiftest of all Mammals."

It appears from the accounts of the natives who capture hunting-leopards that these animals hunt either in pairs or in family parties. After they have gorged themselves they repose in their lair for a couple of days or so, and then proceed to a particular tree, where they meet other members of their kind, whence they probably watch the movements of their expected prey. Such trees are recognized by the marks made on the bark by their claws, and the hunters are in the habit of capturing the leopards by surrounding the tree with a number of rawhide nooses.

From time immemorial tame hunting-leopards have been kept by the native potentates of India, as part of the royal estate, for the purpose of hunting the Indian black buck (antelope) or other game. "In this sport," writes Sir Samuel Baker, "all persons excepting the keepers of the animals, are simply spectators, and no interference is permitted. Each chita occupies a peculiar cage, which forms the body of a cart drawn by two bullocks. When game is expected, the chita is taken from the cage, and occupies the outside seat upon the top, together with the keeper. The animal is blinded by a hood similar to that worn by a falcon, and it sits upright like a dog, with the master's arm around it, waiting to be released from the hood, which it fully understands is the signal that game is sighted."

On the particular occasion described, there were plenty of black buck, and "we were not long," continues Sir Samuel Baker, "in finding a herd, in which were several good old buck, as black as night. Nothing could be more favorable than the character of the ground for the natural habits of the chita. The surface was quite flat and firm, being a succession of glades, more or less open, surrounded by scattered bush. A chita was now taken from its cage, and it at once leaped to the top, and sat with its master, who had released it from the hood. After an advance of about two hundred yards, the wheels making no noise upon the level surface, we espied the herd of about twenty antelopes, and the cart at once halted until they had slowly moved from view. Again the cart moved forward for seventy or eighty paces, and two bucks were seen trotting away to the left, as if they had caught a glimpse of the approaching cart. In an instant the chita was loosed. For a moment it hesitated, and then bounded forward, although the two bucks had disappeared. We now observed that the chita not only slackened its pace, but it crept cautiously forward, as though looking for the lost game. We followed quietly upon horseback, and in a few seconds we saw the two bucks about a hundred and twenty yards distant standing with their attention fixed upon us. At the same instant the chita dashed forward with an extraordinary rush. The two bucks, at the sight of their dreaded enemy, bounded away at their usual speed, with the chita following, until all the animals were lost to view in the scattered bushes. We galloped forward in the direction they had taken, and in less than three hundred yards arrived at the spot where the chita had pinned the buck. This was lying upon its back without a struggle, while the firm jaws of its pursuer gripped it by the throat. The chita did not attempt to shake or tear the prey, but simply retained its hold, thus strangling the victim, which had ceased all resistance.

"The keeper now arranged the hood upon the chita's head, thus masking the eyes, which were gleaming with wild excitement, but it in no way relaxed its grip. Taking a strong cord the keeper now passed it several times around the neck of the buck, while it was still held in the jaws of the chita, and, drawing the cord tight, he carefully cut the throat close to the jaws of the tenacious animal. As the blood spurted from the wound it was caught in a large but shallow wooden bowl or ladle, furnished with a handle. When this was nearly full, the mask was taken off the chita, and, upon seeing the spoon full of blood it relaxed its grasp, and immediately began to lap the blood from the well-known ladle. When the meal was finished, the mask or hood was replaced, and the chita was once more confined within its cage, as it would not run again during that day."

Another account written many years ago by the late Mr. G. T. Vigne, may be quoted, as somewhat amplifying the preceding one in certain points. The hunting-leopard, as soon as slipped from the cart, "walks toward the antelope with his tail straightened and slightly raised, the hackle on his shoulders erect, his head depressed, and his eyes intently fixed upon the poor animal, who does not yet perceive him. As the antelope moves he does the same, first trotting, then cantering after him; and when the prey starts off, the chita makes a rush, to which the speed of a race horse is for the moment much inferior. The chitas that bound or spring upon their prey are not much esteemed, as they are too cunning; the good

ones fairly run it down. When we consider that no English greyhound ever yet, I believe, fairly ran down a doe antelope, which is faster than the buck, some idea may be formed of the stride and velocity of an animal who usually closes with her immediately, but fortunately, cannot draw a second breath, and, consequently, unless he strike the antelope down at once, is obliged instantly to stop and give up the chase. He then walks about for three or four minutes in a towering passion, after which he again submits to be helped on the cart. He always singles out the biggest buck from the herd, and holds him by the throat until he is disabled, keeping one paw over the horns to prevent injury to himself. The doe he seizes in the same manner, but is careless of the position in which he holds her."

Many tame hunting-leopards become perfectly gentle and docile, rubbing themselves against the knees of visitors, and purring all the time like so many large cats. It should be observed that the tamed individuals of this species merely use their own natural instinct and develop no new mental powers as the result of training.

EXTINCT CATS

In the course of this chapter reference has been made to the occurrence of existing species of the Cat family in caverns and other superficial deposits. There are, however, in addition to these, a large number of fossil cats, differing more or less markedly from all existing species, and many of which belong to extinct genera; and no account of the family would be complete without some reference, brief though it must necessarily be, to these extinct types. Some of these, as shown by the greater number of their teeth and other characteristics, belong to what naturalists call more generalized types, and may have been the ancestral forms from which the living cats have originated; while others are more specialized than any of the species living.

Referring first to what may be called true extinct cats, or those belonging to the genus *Felis*, we may mention that from strata belonging to the Pliocene or upper portion of the Tertiary period in the Siwalik hills of India, there have been obtained skulls of the great crested cat (*F. cristata*) which must have been fully as large as the tiger, but appears to show signs of affinity with the jaguar. Equally large cats (*F. atrox* and *F. augusta*) have left their remains in the strata of the same geological period in the United States. Numerous extinct cats of this genus also occur in the Pliocene deposits of France and other countries on the continent of Europe, but these are of smaller dimensions, as also are those found in beds belonging to the upper half of the preceding Miocene period, below which true cats are unknown. The Siwalik hills have also yielded the remains of a cat which is believed to indicate the existence of a species of hunting-leopard at the period when their rocks were in process of formation.

Passing on not only to extinct species but likewise to extinct genera, we may notice first those remarkable creatures known as sabre-toothed cats (*Machærodus*). These cats, some of which were equal in size to the lion and tiger, are all characterized by the enormous development of the tusks, or canine teeth of the

upper jaw, which formed long sabre-like weapons projecting far below the lower jaw, as shown in our greatly reduced figure of the skull of one of the South American species. The great length of the upper tusks must have completely prevented them from biting in the ordinary manner, as, when the mouth was opened to its widest extent, these teeth would still have reached to the lower jaw. Hence the only mode in which they could have been used would appear to have been as striking or tearing weapons when the mouth was closed. In some species the cutting power of these teeth was increased by their sharp edges being finely notched like a saw.



SIDE VIEW OF THE SKULL OF
THE SOUTH AMERICAN SABRE-
TOOTHED CAT.

(Greatly reduced.)

These sabre-toothed cats seem to have abounded in the Pleistocene and Pliocene epochs of the earth's history, their remains having been obtained from the caverns and other superficial deposits of England, the Continent, Persia, India, and North and South America. They are also known from strata of much older age, having been found in France in rocks belonging to the upper part of the Eocene period.

In the Miocene strata of the United States, and also in the Miocene and Upper Eocene rocks of Europe, there are found more generalized cats, many of which differ from existing forms in having three or four (instead of two) premolar teeth in the lower jaw; while some of them also have an extra molar tooth behind the lower flesh-tooth. In the presence of these additional teeth, they approach the other families of Carnivores; and this approximation is also shown by the structure of some of their teeth. Thus in many of them the upper flesh-tooth, instead of having three distinct lobes in the blade as in existing cats, has but two such lobes, as in a dog. In another form the claws, although still retractile, had not the bony sheaths of the modern cats. The animals to which these early cats seem to make the nearest approach are the civets, thus suggesting that the Cat family may have been derived from primitive Carnivores, more or less closely allied to the modern civets and their allies.

CHAPTER XIV

CARNIVORES—*continued*

CIVETS, AARD-WOLF, AND HYÆNAS

The Carnivores described in the present chapter are those which exhibit the nearest affinity to the cats; and they are arranged in three distinct families. The first of these families includes the civets and their allies, and is represented by a large number of species; the second contains only a single species, the African aard-wolf; while the third is formed by the hyænas, of which there are three species now living. The whole assemblage is strictly confined to the Old World—both at the present day, and mainly also in earlier epochs of the earth's history; * and all of the species are inhabitants of the warmer regions of that hemisphere, none of them ranging into the strictly northern countries.

These animals agree with the cats (and thereby differ from all other Carnivores) in certain characteristics connected with the skull, and also in regard to the anatomy of their soft parts. The most obvious feature in connection with the skull is to be found on the under surface in the region of the internal portion of the ear. Here the so-called bulla, lying immediately behind the cavity, for the articulation of the lower jaw, is always inflated into a bladder-like form; the internal cavity of this bladder-like chamber being, except in the hyænas, divided into two compartments by a vertical partition of bone.

THE CIVET TRIBE

Family *VIVERRIDÆ*

Under the general title of civets may be included not only the animals to which that term is properly applicable, but likewise a number of more or less closely-allied Carnivores, such as genets, ichneumons or mongooses, palm-civets, linsangs, etc. This assemblage includes a much more diversified group than that represented by the Cat family, and is, therefore, much less easy of definition; the difficulty being considerably increased by one very aberrant species from Madagascar which connects the more typical members of the family very closely with the cats.

*An extinct Carnivore recently described from North America has been referred to the hyænas.

The whole of these animals have, however, more elongated faces than the cats, and their bodies are also longer, and their legs shorter than in the members of that family, not even excepting the peculiar *eyra*. They have a larger number of cheek-teeth than any of the existing cats, the premolar teeth being never less than three—and very frequently four—on each side of both the upper and lower jaws. Moreover, with the single exception of the above-mentioned species from Madagascar (which is at once distinguished from all the cats by the presence of four premolar teeth), the civets always have two molar teeth in the lower jaw—that is to say, there is a tooth behind the lower flesh-tooth. Further, in nearly all cases there are also two molar teeth in the upper jaw and behind the flesh-tooth; these molar teeth



THE LEFT HALF OF THE UPPER JAW OF THE INDIAN CIVET.

To show the form and number of the teeth. The fourth tooth from the left side of the figure is the tusk, or canine; and the third tooth from the right side the flesh-tooth, or last premolar; the two teeth behind the latter being the molars. (From the *Palæontologia Indica*).

(as shown in the accompanying figure of the upper jaw of the Indian civet) being generally of large size, and thus very different from the single small upper molar of the cats. With the above-mentioned exception, the upper flesh-tooth has but two lobes to the blade; while the lower flesh-tooth has a large tubercular heel behind the cutting blade. As a general rule, their feet have four toes; but in some cases the first

toe (thumb) may be wanting in the fore-feet, in others the corresponding toe may be absent in the hind-feet, while in others, again, both fore and hind-feet may be four toed. Then, again, while in some forms the claws can be withdrawn into sheaths as completely as in the cats, in others they are but partially retractile; this difference depending, as pointed out by Mr. Blanford, to a great extent as to whether the animals walk on their toes (digitigrade), or on the soles of their feet (plantigrade).

None of the civets attain large dimensions; and they are chiefly characteristic of Africa, Madagascar, and Southeastern Asia, only two species entering the southern parts of Europe.

THE FOSSA

Genus *Cryptoprocta*

The fossa of Madagascar, which is the largest Carnivore found in that island, is the species already alluded to as connecting the more typical members of the present family with the cats. This peculiar animal differs, indeed, so remarkably from all the other representatives of the civet tribe, that it has been considered by some that it ought to be referred to a separate family; but in most features it agrees so essentially with the civets that this view is now generally discarded by zoologists.

The fossa (*Cryptoprocta ferox*) is a nearly uniformly-colored animal, with short and thick, pale brown fur; and it attains a total length of about five feet from the snout to the tip of the tail, the length of the tail being more than three-quarters that of the head and body. The curved claws are sharp and retractile; and the feet, each of which is furnished with five claws, are very similar to those of a cat, except that the whole sole of the hind pair is naked, and applied to the ground in walking. The fossa has a total of thirty-six teeth, of which the hinder ones, both in form and number, closely resemble those of the cats. Thus the flesh-tooth in each jaw is cat-like, while there is but a single small molar tooth behind the flesh-tooth in the upper jaw, and none in the lower jaw, the number of molars being therefore $\frac{1}{2}$. Unlike the cats the fossa has four premolar teeth on each side of both



THE FOSSA.
(One-eighth natural size.)

jaws, and thereby resembles the typical civets, although the first of these teeth is generally shed at an early age. It is a purely nocturnal creature, of a fierce disposition, but scarcely anything is yet known of its habits. It was exhibited in the London Zoological Gardens for the first time in 1891.

THE TRUE CIVETS

Genus *Viverra*

The true civets, or typical representatives of the family, are at once distinguished from the fossa by the number and form of their cheek-teeth; the total number of the teeth is forty, of which on each side of both the upper and lower jaws three are incisors, one a canine, four premolars, and three molars. The flesh-teeth;

of which the characteristics have been already briefly mentioned, are like those of the dogs, and thus different from those of the cats; the upper flesh-tooth having but two lobes to the blade (see figure on p. 454), while the lower flesh-tooth has a large heel behind its cutting blade (as seen in the figure of the skull of a fox given on p. 355).

The civets are further characterized by their long and flattened bodies; narrow and elongated heads; short limbs; small and rounded feet, each furnished with five toes, of which the claws are partially retractile; and the hairy soles of the feet (exclusive of the pads). With the exception of one species, the back has a crest of long hairs, which can be erected at will; the neck is marked by a black gorget; and the tail, which is of considerable length, is variegated by alternate dark and



THE CIVET.
(One-sixth natural size.)

light rings. The whole of the fur is long and rough looking, and thus presents a marked contrast to the sleek pelage of most of the cats. The civets all walk on the very tips of their toes. In addition to the above, all these animals are characterized by the great development of certain glands situated in the abdomen which secrete the well-known perfume which gives the name to the group. There are altogether six species of true civets, of which five are Asiatic, while one is African; one of the Asiatic species being smaller than all the others, from which it also differs by the absence of the crest of erectile hairs on the back. From this and other structural differences, this small civet is frequently referred to a distinct genus. Like the majority of the family, the true civets are nocturnal, and to a great extent solitary animals; and apparently some of them cannot climb. They are commonly known as civet cats.

African Civet The African civet (*Viverra civetta*), which is one of the larger members of the genus, inhabits the tropical portions of Africa; and is of a brownish-gray ground color, marked with interrupted dark streaks, or blotches, over the whole body. The tail is dark colored, with the rings very indistinct in the terminal portion. Little is recorded of its habits in the wild state; but these are probably similar to those of the next species. This civet, together with other species belonging to the same genus, and likewise some of other genera, is kept in cages for the purpose of obtaining its secretion, which is, however, now much less used in Europe than formerly.

Indian Civet This civet (*V. zibetha*), of which the upper teeth are figured on p. 454, is an animal of nearly the same size as its African cousin, its total length being fifty inches, of which eighteen are occupied by the tail. It is



THE INDIAN CIVET.
(One-sixth natural size.)

distinguished by having the erectile crest on the back, of a deep black color; thus forming a distinct black stripe running from the shoulders to the first ring on the tail, which is bordered on either side by a pale band. There are several dark bands on the chest, shoulders, and thighs; but the sides of the body are either plain colored or with very indistinct markings; the general color of the fur being a dark gray, frequently with a more or less decided yellowish or brownish tinge. The tail is marked with six black rings, which are much wider than the intervening white ones; its tip being black. The Indian civet inhabits the eastern side of India, from Bengal to Sikhim, ascending in the last-named district to a considerable elevation in

the Himalayas, and it is also found in Burma, the Malay Peninsula, Siam, and Southern China. Mr. Blanford states that this civet is generally a solitary animal; and that "it hides in woods, bushes, or thick grass during the day, wandering into open country and often coming about houses at night. Not unfrequently it is found in holes, but whether these are dug by it is doubtful. It is said to be very destructive, killing any birds or small Mammals it can capture, and often attacking fowls, ducks, etc., but also feeding on snakes, frogs, insects, eggs, and on fruits and some roots." Civets take readily to water. The female produces during May or June three or four young at a birth, which are probably born with their eyes open. Hounds and other dogs, when they come across the trail of a civet, are said to leave that of any other animal they may be pursuing.

The Malabar civet (*V. civettina*), which replaces the preceding on the Malabar coast, is a closely allied species, distinguished by the large transverse markings on the sides of the body.

Burmese Civet The fourth, or Burmese civet (*V. megaspila*), may be recognized by the black line of the back being continued down the upper surface of the tail, in which the dark rings are continuous below, and at first not wider than the light interspaces. The sides of the body are marked with rather large and usually distinct spots, which may tend to coalesce into bands; and the terminal portion of the tail is black for a greater or lesser extent. This species seems to attain larger dimensions than the Indian civet, Mr. Blanford giving the total length of one example as fifty-four and one-half inches, of which the tail occupied seventeen and one-half inches. It inhabits Burma, the Malay Peninsula, Cochin-China, and the island of Sumatra.

Javan Civet The last of the five more typical species is the Javan civet (*V. tan-galunga*), which is closely allied to the last, but distinguished by its smaller size, and the incompleteness of the dark rings on the under side of the tail. This species has been recorded from Java, Sumatra, Borneo, and the Philippines. According to Mr. Wallace it also occurs in the islands of the Molucca group, where, however, it may very probably have been introduced by the Malays, who are in the habit of carrying civets about in cages to the various islands, where they are bought for their secretion. Dr. Guillemard relates, on the authority of a Dutch informant, that in Java a so-called "wild cat," which is very probably this species, has the curious habit of eating ripe coffee berries, for the sake of their fleshy external covering.

Rasse The last of the true civets is the rasse (*V. malaccensis*), the smallest member of the group, and distinguished, as already mentioned, from the others by the absence of erectile hairs along the middle of the back. As shown in our figure on the next page, it is a more slightly-built and sharper-nosed animal than the others, with more curved and slender claws. The ground color of the fur is some shade of brownish gray or yellowish brown; upon which there are usually longitudinal dark lines down the back, and also rows of spots along the sides of the body. The dark rings on the tail vary from seven to nine in number. In size the rasse varies from thirty-six to forty inches in total length; from fifteen to seventeen inches of this being taken up by the tail. This small civet is found over the

greater part of India, although not occurring in Sind and the Punjab, and some of the adjacent portions of Rajputana. It is also found in Ceylon, and extends eastward from India through Assam to Burma and the Malay Peninsula, and thence to Southern China, Java, and other islands. It has been introduced into Socotra, Madagascar, and the Comoro Isles. The *rasse* is said to differ from the other true civets in being a good climber and arboreal in its habits. It is, however, found in bush-covered districts rather than in thick forests; dwelling either in holes in the ground or among rocks. In confinement it is easily tamed, and feeds on such small animals as it can catch.

The comparatively large number of true civets inhabiting India and Malaysia, as contrasted with the single representative of the genus found in Africa, suggests



THE RASSE.
(One-seventh natural size.)

that in the later periods of the earth's history the Oriental region was the original home of the group. This is confirmed by what we know of their past history, for the remains of an extinct species have been found in a cavern in Madras, and those of two others in the Pliocene rocks of the Siwalik hills in the north of India; one of the species from the latter district being far larger than any existing civet.

At a still earlier period—in the Lower Miocene and Upper Eocene—civets were inhabitants of Western Europe, their remains having been discovered both in England and on the Continent. We have thus another instance of the derivation of the modern mammalian fauna of the East from the old European fauna, to which

we have had occasion to allude. The old civets of Europe differ somewhat in the characteristics of their teeth from the living species, but appear in other respects to have been nearly allied. Very few of the existing genera of Mammals date so far back as the upper portion of the Eocene period, and civets may be regarded as one of the oldest groups in the class.

Omitting mention of an animal from Madagascar closely allied to the rasse, and known scientifically as the *Fossa*—which must not be confounded with the fossa mentioned above—our next representatives of the family are



THE GENET.
(One-fourth natural size.)

THE GENETS

Genus *Genetta*

Among the little animals known as genets is one of the two members of the civet family found in Europe. Although nearly related to the true civets, the genets may be distinguished by the greater proportionate length and slenderness of their bodies, and their shorter legs, as well as by their longer and more tapering tails, and their shorter and blunter claws. Then, again, the hind-foot of a genet



LINSANGS.

will be found to differ from that of a true civet by having a narrow naked surface extending for a long distance in the under surface behind the pads. Another point of difference is to be found in the absence in the genets of a pouch for containing the secretion; a characteristic in which they agree with the fossa described on p. 454. All these animals have short and soft fur, of which the ground color is brownish yellow or grayish. Down the middle of the back runs a black line, while the sides of the body are marked with black or brown spots; and there are also characteristic dark and light markings on the head and face. The black rings on the tail, which are variable in number, are generally narrower than the intervening white spaces.

As the true civets are mainly Oriental in their distribution, having only one species beyond the limits of that region, so the genets are chiefly African. The common genet (*Genetta vulgaris*), which occurs in the northern part of Africa, is, indeed, the only species found beyond that continent, its range extending into Spain, the south of France, and Southeastern Asia. In 1890 a single specimen was recorded from the department of Eure, in the north of France. It is definitely known from Asia in Syria, but may also occur in Southeastern Persia. Of the four exclusively African species, the blotched genet (*G. tigrina*) ranges from the Cape to Abyssinia, the feline genet (*G. felina*), is South African, while the remaining species (*G. senegalensis* and *G. pardina*) are from the West Coast. Genets are easily tamed; and in the south of Europe the common species is often kept in houses for the purpose of killing rats and mice.

THE LINSANGS

Genera *Linsang* and *Poiana*

The most beautifully colored of the civet-like animals are the linsangs, of which there are three nearly allied Oriental species, and a fourth from Africa. All the linsangs—the name would seem to be of Malayan derivation—are characterized by their very long and slender bodies, the shortness of their limbs, the elongation of the head and neck, and the extreme length of the tail, which may exceed that of the head and body together. The claws can be completely withdrawn within their sheaths; the whole of the soles of the feet are generally hairy; and there is no scent pouch. The fur is characterized by its shortness and softness, and is very thick, so that the skin is almost like velvet pile. The ground color of the fur is some shade of fulvous, marked with bold black spots or patches; the long tail being ringed with black. On account of their striking and handsome coloration, the name of tiger-civets has been suggested for these animals. An examination of the skull will show that instead of the forty teeth found in the true civets and genets, they have only thirty-eight; this diminution being due to the loss of the second upper molar, so that there is but one tooth behind the flesh-tooth of the upper jaw instead of the two shown in the figure on p. 454.

They are all carnivorous, but it is suggested that some of them may also feed on insects. The Asiatic linsangs are characterized by the large size of their spots,

which frequently form squarish patches, tending to form transverse bands. These species constitute the genus *Linsang*.* The one African linsang, on the other hand, has smaller spots, which have no tendency to run into bands over the greater part of the body. It has also a naked line running up the sole of the hind-foot, as in the genets. From these slight differences this animal has been made the type of a separate genus—*Poiana*.

The earliest known of these animals was the Javan linsang (*Linsang gracilis*), from Java, Borneo, and perhaps Sumatra, shown as the upper figure of our colored plate. It is the smallest of the linsangs, with a coloration similar to that of the next species, but with a different kind of skull.

The Burmese linsang (*L. Maculosus*), which is the largest, and perhaps the handsomest, of the group, appears to be a rare animal, and is at present known only by two specimens, one obtained from near Moulmein, and the other in South Tenasserim. It is represented in the lower figure of the plate. The tail is slightly shorter than the head and body; the length of the two latter being about nineteen inches, and that of the former (including the hair at the tip) just under seventeen inches. The body has a grayish ground color marked with about six very broad and somewhat irregular brownish-black transverse bands extending across the back, and separated by very narrow intervals. On the flanks and neck the markings form broken longitudinal lines and spots, one very distinct line always extending from behind the ear to the shoulder. The outer surfaces of the fore-limbs and of the thighs are spotted; and the tail has seven complete dark rings, separated by narrower light interspaces; its tip, as in the genets, being lighter.

The spotted linsang (*L. pardicolor*), which is found from the Southeastern Himalayas to Yunan, is a somewhat smaller animal; the length of the head and body being only fifteen inches. It is readily distinguished by its coloration; the back being marked with longitudinal rows of large oblong spots, instead of the transverse bands of the last species.

A tame specimen of this beautiful animal was once kept by Mr. Brian Hodgson in Nipal. He describes it as very docile, fond of notice, and never giving vent to any kind of sound. It was free from the strong odor characteristic of the true civets, and was fed upon raw meat. Mr. Hodgson states that in its wild condition this species is equally at home on trees and on the ground; and that it dwells and breeds in the hollows of decayed trees. It is not gregarious at all, and preys chiefly upon small birds, upon which it is wont to pounce from the cover of the grass. The times of breeding are said to be in February and August, and the litter to consist of two young, there being two litters each year.

The African linsang (*Poiana poënsis*), of which some of the distinctive characteristics have been already mentioned, is found only on the West Coast, in Sierra Leone and Fernando Po, and is, therefore, widely separated from its Oriental relatives. The tail is somewhat longer than the head and body, measuring upward of forty and one-half inches; whereas the total length of the head and body is but thirty-eight inches. The spots, as already mentioned, are smaller than in the Ori-

*The name *Prionodon* is generally used in this sense, but it clashes with a nearly similar name applied to an armadillo.

ental linsangs, and, with the exception of some stripes on the back of the head, and a line extending from the neighborhood of the ear to the shoulder, do not run together into lines or patches. The tail is peculiar in that the light rings separating the large dark bands are divided in the middle by very narrow dark rings.

THE PALM-CIVETS

Genus *Paradoxurus*

The palm-civets, tree-cats, or toddy-cats, as they are indifferently called, form an Asiatic group, with a single outlying West African species, of civet-like animals,



THE COMMON PALM-CIVET.
(One-fifth natural size.)

differing in several important respects from all the preceding types, which are more or less closely allied. The number of the teeth is the same as in the true civets; but the individual teeth are usually much smaller in proportion to the size of the skull; and the flesh-teeth are by no means of such a markedly cutting type. There are also important distinctions in the structure of the skull. In most cases the tail is uniformly colored, or only ringed at its base. Moreover, all these animals are largely of arboreal habits.

The typical palm-civets, constituting the genus *Paradoxurus*, are exclusively Asiatic, ranging from India and Burma through the Malayan region to the south of

China, and also occurring in the Philippines, Celebes, and Formosa. They may be either uniformly colored or striped, and, with one exception, have no rings on the tail, which is very long, but not prehensile. In size most of them may be compared to a large cat with relatively short legs. Their ears are small and rounded, the pupil of the eye is vertical, and the claws are completely retractile. The most distinctive external feature is to be found, however, in the soles of the feet, which, in both the fore and hind-limbs are almost completely naked; the bald area being continued backward from the foot-pads without the intervention of any hairy space.

The palm-civets are purely nocturnal and thoroughly arboreal in their habits; their food in accordance with the structure of their teeth consisting in part of animal and in part of vegetable substances. The name *Paradoxurus*—often anglicized into *Paradoxure*—was given to these animals on account of a caged specimen in Paris having its tail coiled up in a peculiar manner. It was believed that this was the normal condition, and that the tail could be used as a prehensile organ. It appears, however, that although the palm-civets have naturally some power of coiling and uncoiling their tails, yet that the permanently coiled condition, as shown in the Paris and some other caged specimens, is a kind of disease due to the effects of captivity. Altogether there appear to be upward of eleven well-distinguished species of true palm-civets, five of which are found in India and Burma. In nine of these species the tail is considerably more than half the length of the head and body; and in eight of these it is uniformly colored. The Celebes palm-civet (*P. musschenbroeki*), forming the ninth in this series, is, however, distinguished by having its tail banded with indistinct rings of darker and lighter brown. The imperfectly-known woolly palm-civet (*P. laniger*), was described upon the evidence of a single skin, said to have been obtained from Tibet, and differs from all the rest in the woolly nature of its fur, and also by the length of the tail not exceeding that of the head and body. It is not certain that it really belongs to the same genus as the other species. The eleventh species is known only by a skull remarkable for the large size of its teeth.

The best known of all the species is the common Indian palm-civet (*P. niger*),* found throughout the greater part of India and Ceylon, and figured on p. 457. In this species the tail is nearly or quite as long as the head and body; and the general color of the coarse and somewhat ragged fur a blackish or brownish gray, without any stripes across the back in fully adult individuals. The length of the head and body of a male measured by Mr. Blanford was twenty-two and one-half inches, and that of the tail nineteen and one-half inches; the corresponding dimensions of a female being in one instance twenty and seventeen and one-half inches, while in a second both were about eighteen inches.

Writing of this species, the late Dr. Jerdon observes that "it lives much on trees, especially on the palmyra and cocoa palms, and is often found to have taken up its residence in the thick thatched roofs of native houses. I found a large colony of them established in the rafters of my own house at Tellicherry. It is also occasionally found in dry drains, outhouses, and other places of shelter. It is quite

* Also known as *P. musanga*.

nocturnal, issuing forth at dark, and living by preference on animal food, rats, lizards, small birds, poultry, and eggs; but it also freely partakes of vegetable food, fruit, and insects. In confinement it will also eat plantains, boiled rice, bread and milk, etc. Colonel Sykes mentions that it is very fond of cockroaches. Now and then it will commit depredations on some poultry-yard, and I have often known it taken in traps baited with a pigeon or a chicken. In the south of India it is very often tamed, and becomes quite domestic, and even affectionate in its manners. One I saw at Trichinopoli went about quite at large, and late every night used to work itself under the pillow of its owner, roll itself up into a ball, with its tail coiled round its body, and sleep till a late hour in the day. It hunted for rats, shrews, and lizards. Their activity in climbing is very great, and they used to ascend and descend my house at one of the corners in a most surprising manner." This palm-civet is common in Lower Bengal, and in the gardens of the suburban residences of



THE MALAY PALM-CIVET.
(One-seventh natural size.)

Calcutta may occasionally be seen in the late afternoon or evening crawling among the leaves of a palm previous to starting on its nocturnal wanderings. That it will sometimes take up its quarters in the very heart of the town of Calcutta is proved by an incident which happened to the present writer when on the staff of the Geological Survey of India. At that time (1874) the office of the Survey was situated in a street leading down to the Hughli, in the old part of the city. On arriving at the office he found his papers on the writing table marked every morning with the footprints of some Mammal. He thereupon procured a packing-case, which he converted into a 4-trap, and set, properly baited, one night in his room. Next morning he found that the box had fallen, with a tenant inside. The tube of a sulphureted-hydrogen bottle was then inserted through a hole bored in the side of the box, and the latter, after an interval, lifted, when the dead body of a palm-civet was disclosed.

The name of toddy-cats is applied to these animals from the partiality they, in common with the fox-bats, display in Southern India and Ceylon for the palm juice, or toddy, collected by the natives in vessels suspended on the trees. Like the other members of the group, the Indian palm-civet, when irritated, gives forth a most unpleasant odor.

The Malay palm-civet (*P. hermaphroditus*), which is represented in the illustration on p. 465, occurs throughout the countries to the eastward of the Bay of Bengal, as far as Siam, and is distinguished from its Indian congener by the presence of a pale-colored band running across the forehead, and also by the general presence of stripes across the back in the adult condition. In both the preceding species the "whiskers" are black, but in the golden palm-civet (*P. aureus*) of



THE CHINESE PALM-CIVET.
(One-fourth natural size.)

Ceylon, and also the brown palm-civet (*P. jerdoni*) of Southern India, they are respectively rufous and dark brown; the body color of those two species being nearly the same as that of their whiskers. On the other hand, the Himalayan palm-civet (*P. grayi*), which occurs throughout Sikhim and Assam, is readily distinguished by its white whiskers; while it is further characterized by the great backward production of the bony palate of the skull. The golden palm-civet is said to be less carnivorous than the other species.

The Chinese palm-civet (*P. larvatus*), of which we give a figure on this page, is closely allied to the Himalayan palm-civet, but differs by the browner tinge of its grayish fur, and by the markings on the head being very distinct, and black

and white in color. It has also a broad white band running down the head and nose. It is rather smaller than the Himalayan palm-civet, although its exact dimensions are still unknown. In Southern China this palm-civet is found in Hanghow, and the provinces of Kwangtung and Fokien; and it likewise inhabits the island of Formosa.

THE SMALL-TOOTHED PALM-CIVETS

Genus *Arctogale*

The two species of small-toothed palm-civets are distinguished (as their name implies), among other characteristics, from the members of the preceding genus by their relatively smaller cheek-teeth, and have hence been referred to a distinct genus, under the name of *Arctogale*. Externally these civets may be readily distinguished from the typical palm-civets by the soles of their feet being still more extensively naked, and likewise by the greater degree of divergence of the first toe of both pairs of feet from the other digits. The white-eared small-toothed palm-civet (*A. leucotis*) is an inhabitant of Assam, Burma, Tenasserim, the Malay Peninsula, Sumatra, and Java; while the second species (*A. trivirgata*) is restricted to the island last mentioned. The former is a short-furred animal, of a fulvous or dusky-gray color, sometimes nearly brown on the back, and always paler below, with a tail about as long as the head and body. It is readily distinguished by the presence of three dark bands, which may be either continuous, or broken up into spots, running down the back of the otherwise uniformly-colored body. In a male specimen the total length of the head and body was twenty-six and one-half inches, and that of the tail twenty-seven inches. When taken young it is said to be readily tamed. The small size of the cheek-teeth—especially the nearly triangular form of the upper flesh-tooth—suggests that it feeds largely upon vegetable substances. The second species is closely allied, having three similar dark stripes down the back.

THE HEMIGALES

Genus *Hemigale*

Another type of palm-civet is represented by the so-called Hemigale, for which there does not appear to be any recognized English title. Of this genus there are two species, the one, Hardwicke's hemigale (*H. hardwickei*), found both in the Malay Peninsula and Borneo, and the other, or Hose's hemigale (*H. hosei*), confined to Mount Dulit in the northern part of the latter island, where it has only recently been discovered. The hemigales are distinguished from the other palm-civets by having a much smaller portion of the soles of the feet naked, and likewise by their coloration, which is different from that of any other representative of the family, although approached to some extent by the linsangs. This characteristic coloration takes the form, in the typical Hardwicke's hemigale, of a variable number of broad transverse dark bands crossing the back, of which the ground color is a

pale brownish gray ; the number of these bands being very generally either five or six. There are also some dark longitudinal stripes on the nape of the neck ; while the upper half of the tail is banded with dark rings. A peculiarity of these animals is that the direction of the hair on the back of the neck is reversed. Their habits are probably very similar to those of the other palm-civets.

THE AFRICAN PALM-CIVET

Genus *Nandinia*

The last member of this group is the African palm-civet (*Nandinia binotata*), which, although nearly allied to the Oriental forms, is distinguished by certain structural peculiarities in the skull, and also by having a shorter muzzle than any other member of the family to which it belongs. The fur is of a grayish-brown color, with the back and sides marked with large dark spots, and a pale spot on either side of the shoulders from which it takes its second scientific name. The tail, which is about two-thirds the length of the head and body, is indistinctly ringed with dark bands ; the animal thus being the fourth representative of the palm-civets in which the tail is thus ornamented. In size this animal is rather smaller than the average of the typical palm-civets.

The African palm-civet is found on the West Coast, in the district of Fernando Po ; and it will be thus apparent that it presents precisely the same relation to the Oriental palm-civets in respect to geographical distribution as is presented by the African linsang to its Eastern cousins. We are not acquainted with any account of the habits of this animal, but the nature of the teeth suggests that it lives largely on flesh.

THE BINTURONG

Genus *Arctictis*

The remarkable animal, represented in the illustration on p. 469, and known as the binturong, or bear-cat, although nearly allied to the palm-civets, is yet so different from the members of that group in certain respects as to be entitled to notice under a special heading. It is the sole representative of its genus, and has a rather wide distribution in the Oriental region, ranging from Assam through Arakan, Tenasserim, Siam, the Malay Peninsula, Sumatra, and Java. The binturong (*Arctictis binturong*) is distinguished from all the other members of the civet family by the long tufts of hair surmounting the ears, and also by the prehensile nature of the long and somewhat bushy tail. As regards size, the length of the head and body varies from twenty-eight to thirty-three inches, and that of the tail from twenty-six to twenty-seven inches. The tail is thus nearly as long as the head and body, and it is characterized by its great thickness at the root, from which it tapers gradually ; it is covered with bristly straggling hairs, which exceed in length those of the body. The whole of the fur is, however, long and coarse,—

more especially on the back,—and is of a uniform black tint, more or less washed with gray on the head and fore-limbs, and occasionally all over the body.

The cheek-teeth of the binturong, although of the same general type, are even proportionately smaller than in the small-toothed palm-civets, with which they agree in number. The last molar tooth in the upper, and the first premolar in the lower jaw may, however, be wanting in some individuals. These peculiarities in the teeth, coupled with the other structural characteristics of the animal, lead to the conclusion that the binturong is a highly modified and specialized member of the palm-civet group, of which the nearest relatives are the small-toothed palm-civets.



THE BINTURONG.
(One-seventh natural size.)

Writing of the habits of the binturong, Mr. Blanford observes that it "is omnivorous, living on small Mammals, birds, fishes, earthworms, insects, and fruits; it is also nocturnal and arboreal, its power of climbing about trees being much aided by its prehensile tail. It is rather slow in its movements. Its ability to suspend itself by its tail has been questioned, but Blyth has shown that the young, at all events, can support itself by the extremity of the tail alone. Blyth also remarks that it is the only known placental Mammal with a truly prehensile tail in the Old World. This species inhabits wild forests, and, owing to its nocturnal and retiring habits, is seldom seen; it is said, however, to have a loud howl. It is naturally fierce, but

when taken young is easily tamed, and becomes very gentle and playful. Of its breeding, nothing appears to be known." It has been stated that in the young state the binturong is spotted.

THE CYNOGALE

Genus *Cynogale*

As the palm-civets and the binturong represent the arboreal type of the family under consideration, so the cynogale (for which there is no English name) presents us with a form adapted specially for a partially aquatic mode of life.



THE CYNOGALE.
(One-fourth natural size.)

This animal (*Cynogale bennetti*) is another inhabitant of the eastern part of the Oriental region, where the civet tribe attains its greatest and most peculiar development, being found in the Malay Peninsula and the islands of Borneo and Sumatra. In appearance the cynogale somewhat resembles a small otter, the muzzle being very broad and furnished with thick bristles, while the body is shorter and stouter than in other members of the family, and the tail unusually short, its total length being only some six inches, while that of the head and body is upward of twenty-four inches. The toes of the feet are webbed at their bases, and are further remarkable for their shortness. The teeth are the same in number as those of the palm-civets, but the premolars have usually tall crowns, apparently adapted for holding and biting the fish, upon which it largely subsists.

According to Mr. Wallace, this animal is exceedingly rare in Borneo. Not only does it swim well and readily, but it is also said to be a ready climber. In addition to fish, crabs, etc., which form a considerable proportion of its diet, it is also reported to eat the flesh of such land animals as it can catch, and likewise various fruits.

THE MUNGOOSES

Genus *Herpestes*, etc.

Of late years the time-honored name ichneumon, applied to the Egyptian representative of the group of civet-like animals, into the consideration of which we now enter, has been very generally rejected by zoological writers in favor of the term mongoose, the native Indian name for the Oriental species.

Using, then, the latter term, the mongooses form a well-defined group of small civet-like animals, with very long and generally uniformly-colored bodies and tails, which differ in several important characteristics from the members of the family hitherto noticed. A large number of the mongooses are included in the typical genus *Herpestes*, of which the range includes not only the African, but also the Indian and Malayan regions; and of which one species is found in Spain. The other mongooses come from Africa, which may thus be regarded as the headquarters of the group.

The mongooses differ from the members of the civet family yet described by several important modifications in the structure of the skull, into the consideration of which it would be impossible to enter in the present work. It may be observed, however, that the socket of the eye (orbit) is very frequently surrounded by a complete bony ring, while in all the forms hitherto noticed it is widely open behind; and that the teeth are always relatively tall, with sharp cusps adapted for a thoroughly carnivorous diet. Mongooses may be distinguished at a glance by their long straight claws, which are incapable of retraction, and are, therefore, always protruded, like those of a dog; and no mongoose ever has scent glands comparable to those so generally present among the true civets and palm-civets.

So important are these differences that zoologists now divide the civet tribe into three primary groups, or subfamilies; the first of these being represented solely by the fossa of Madagascar, the second including the true civets, genets, palm-civets, etc., and the third the mongooses and their allies.

The true mongooses, or those constituting the genus *Herpestes*, are so well known as to be familiar to many of our readers. They have long, weasel-like bodies, and a more or less elongated tail, which is generally thick at the root, and may be covered with long hair; its general color being like that of the body, but the tip often darker. The longer hairs of almost all the mongooses are marked with alternate darker and lighter rings, which communicate a peculiar and characteristic speckled appearance to the fur. The head has a pointed muzzle, with a rather short nose, in which there is a median groove on the completely naked under surface. The ears are small and rounded. The limbs are likewise of extreme shortness, the



EGYPTIAN MUNGOOSES

feet being provided with five toes, of which the first, both in front and behind, is extremely small. These toes are generally detached; but may be slightly connected by a small web at their bases. The under surfaces of the fore-feet are generally naked; while in most cases only the front part of the soles of the hind-feet are free from hair. It may be added that most mongooses have the same number of teeth as the true civets, that is forty; but, owing to the loss of a premolar on each side of the lower and upper jaws, in some species the number may be reduced to thirty-six.

As already mentioned, the true mongooses have a wide distribution, ranging over the greater part of Africa, extending across the straits of Gibraltar into Spain, and eastward through the south of Asia as far as the islands of the Malayan region. The number of species belonging to the typical genus is comparatively large, Africa claiming eight* (among which is the one ranging into Spain), and the same number being recognized by Mr. Blanford from India, Ceylon, and Burma. In respect to size the mongooses exhibit a considerable degree of variation, for, whereas the head and body of the smallest species may be compared to those of a weasel, the larger forms rival a domestic cat in dimensions. Summarizing the habits of the mongooses, Mr. Blanford describes them as terrestrial Carnivores, seeking their prey on the ground, and very rarely climbing trees. They are active, bold, and predacious, and live on small Mammals, birds and reptiles, insects and eggs, and occasionally eat fruit. They are deadly enemies to snakes, as described under *H. mungo*. They live in holes in the ground, hollow trees, and similar places. When angry or excited, they erect their long hairs, and especially those of their tails.

The typical representative of the genus is the Egyptian mongoose or ichneumon (*H. ichneumon*), inhabiting Africa, north of the Sahara Desert, Palestine, Asia Minor, and the southern portions of Spain. It was one of the sacred animals of the ancient Egyptians, and is often depicted on their frescoes. It is reported to feed largely upon the eggs of crocodiles, although this habit has not been recorded of any of the Indian species. It was, and we believe still is, domesticated in Egypt; and has the same antipathy to snakes alluded to under the head of the common Indian species. The Egyptian mongoose is a large species; the length of the head and body being about twenty inches, and that of the tail some fifteen or sixteen inches. It is characterized by the tip of the tail being black, and the grizzled, grayish-brown color of the fur, in which the individual hairs are ringed with reddish brown and creamy yellow. South of the Sahara this species is replaced by the slightly larger but closely allied caffre mongoose (*H. caffer*), in which the hairs are ringed with black and white. In South Africa, as far north as Zanzibar, we have also a much smaller species, the slender mongoose (*H. gracilis*), agreeing with the two preceding forms in the black tip to the tail, while in Kordofan the nearly equal-sized, red-tailed mongoose (*H. sanguineus*) is distinguished by its general fawn-colored fur, and the red tip to the tail.

Three other South and West African mongooses of large size are characterized by the tip of the tail being of the same tint as the body color. The largest and most distinct of the African species is, however, the white-tailed mongoose (*H. albicauda*), in which the length of the head and body varies from twenty-two

* There is also a species known only by the skull, which is believed to be African.

to as much as twenty-six inches. This species is distinguished from all the above by the under surface of the ankle being hairy, instead of nearly or quite naked, and also by its bushy tail. The general color is blackish gray, the longer hairs being ringed with black and white, and having the tips black. According to Mr. Thomas, the white-tailed mongoose presents a remarkable individual variation in the color of the fur of the tail. The hairs are of considerable length, "in some cases with white bases and long shining black tips, so that the whole tail appears to be black; in others with a long white tip beyond the black, so that then the tail appears to be white; in the latter case the hairs at the extreme tip of the tail being generally wholly white." This species ranges from the eastern part of Abyssinia to Natal, and reappears on the West Coast in the Guinea district.



THE INDIAN MUNGOOSE.
(One-fifth natural size.)

Of the Oriental mongooses we select for especial notice the common Indian mongoose (*H. mungo*), which belongs to a group of several species characterized by their uniform coloration, there being no stripe on the neck and no black tip to the tail. It is a comparatively large species, with rather long hair, of which the general color is gray or rufous; the length of the head and body varying from fifteen to eighteen inches, and that of the tail from fourteen to fifteen inches. This species is found throughout peninsular India, from the Himalayas to Cape Comorin, and also occurs in Ceylon, although unknown in the countries to the eastward of the Bay of Bengal. The common Indian mongoose, writes Mr. Blanford, "is found in hedgerows, thickets, groves of trees, cultivated fields, banks of streams, and broken bushy ground, but not commonly in dense forests. It is often found about houses. It lives and breeds in holes dug by itself. Very little appears to be

known of its breeding habits. It is often seen in pairs. The young are three or four in number, and are produced in the spring. The food of this animal is varied. It lives principally upon rats and mice, snakes and lizards, such birds as it can capture, eggs and insects; but it eats fruit at times. The stomach of one killed near Secunderabad contained, according to M'Master, a quail, a small wasp's nest, a lizard, a number of insects, and part of a custard apple." In disposition this animal, for its size, is decidedly fierce and bloodthirsty. Jerdon says that "not unfrequently it gets access to tame pigeons, rabbits, or poultry, and commits great havoc, sucking the blood only of several. I have often seen it," he adds, "make a dash into a veranda where some cages of mynas, parakeets, etc., were daily placed, and endeavor to tear the birds from their cages."

In spite of its natural fierceness, the mungoose is easily tamed, and forms a gentle and affectionate pet. Tamed mungoses are largely carried about in India by snake charmers and other wandering showmen. The following excellent account of a tame mungoose of this species (which ultimately died from grief at the absence of its master) is given by Mr. R. A. Sterndale: "I got it," writes the narrator, "while on active service during the Indian Mutiny, when it was a wee thing, smaller than a rat. It traveled with me on horseback in an empty holster, or in a pocket, or up my sleeve; and afterward, when my duties took me out into camp, 'Pips' was my constant companion. He knew perfectly well when I was going to shoot a bird for him. He would stand up on his hind-legs when he saw me present the gun, and run for the bird when it fell. He had, however, no notion of retrieving, but would scamper off with his prey to devour it at leisure. He was a most fearless little fellow, and once attacked a big greyhound, who beat a retreat. In a rage his body would swell to nearly twice its size, from the erection of the hair; yet I had him under such perfect subjection that I had only to hold up my finger to him when he was about to attack anything, and he would desist. I heard a great noise one day outside my room, and found 'Pips' attacking a fine male specimen I had of the great bustard (*Eupodotis edwardsi*), which he had just seized by the throat. I rescued the bird, but it died of its injuries. Through the carelessness of my servants, he was lost one day in a heavy brushwood jungle some miles from my camp, and I quite gave up all hope of recovering my pet. Next day, however, in tracking some antelope, we happened to cross the route taken by my servants, when we heard a familiar little yelp, and down from a tree we were under rushed 'Pips.' He went to England with me after that, and was the delight of all the sailors on board ship, for his accomplishments were varied. . . . From watching him, I observed many little habits belonging to these animals. He was excessively clean, and, after eating, would pick his teeth with his claws in a most absurd manner. I do not know whether a mungoose in a wild state will eat carrion, but he would not touch anything tainted, and, though very fond of freshly-cooked game, would turn up his nose at 'high' partridge or grouse. He was very fond of eggs, and, holding them in his fore-paws, would crack a little hole at the small end, through which he would suck the contents. He was a very good ratter, and also killed many snakes against which I pitted him. His way seemed to tease the snake into darting at him, when, with inconceivable rapidity, he would pounce on

the reptile's head. He seemed to know instinctively which were the poisonous ones, and acted with corresponding caution. I tried him once with some sea snakes, which are poisonous, but he could get no fight out of them, and crunched their heads off, one after the other."

Much has been written as to the combats of both the Egyptian and the Indian mongoose with venomous snakes, and also as to the alleged immunity of these animals from snake poison. On these points Mr. Blanford writes as follows: "The prevalent belief throughout Oriental countries is, that the mongoose, when bitten, seeks for an antidote, an herb or root known in India as *manguswail*. It is scarcely necessary to say that the story is destitute of foundation. There is, however, another view, supported by some evidence, that the mongoose is less susceptible to snake poison than other animals. The mongoose is not always willing to attack, though at other times he is ready enough to fight. I have not seen many combats, but so far as I can judge from the few I have witnessed, Jerdon and Sterndale are correct in their view that the mongoose usually escapes being bitten by his wonderful activity. He appears to wait till the snake makes a dart at him, and then suddenly pounces upon the reptile's head and crunches it to pieces. I have seen a mongoose eat up the head and poison glands of a large cobra, so the poison must be harmless to the mucous membrane of the former animal. When excited, the mongoose erects its long stiff hair, and it must be very difficult for a snake to drive its fangs through this and through the thick skin which all kinds of *Herpestes* possess. In all probability a mongoose is very rarely scratched by the fangs, and, if he is, very little poison can be injected. It has been repeatedly proved by experiments that a mongoose can be killed, like any other animal, if properly bitten by a venomous snake, though even in this case the effects appear to be produced after a longer period than with other Mammals of the same size."

In addition to being a benefactor to the human race as a destroyer of poisonous snakes, the Indian mongoose (like its Egyptian cousin) is equally valuable as an exterminator of rats; ships having more than once been cleared of these pests in a comparatively short period by the introduction of a mongoose. In 1871 the sugar-planting industry in Jamaica was threatened with annihilation from the damage inflicted on the canes by a particular species of rats, which absolutely swarmed in the island. After ferrets, toads, and ants had been tried with more or less ill success to stay the plague, Mr. W. B. Espeut bethought himself of introducing the Indian mongoose. Accordingly, in the spring of 1872, nine of these animals were imported and let loose in the island. "Within a few months," writes Mr. Espeut, "young ones were seen about, and in less than six months there was evidence, clear and certain, that the rats were much less destructive than they had ever been known. Fewer rats were caught and fewer canes were destroyed, month after month. Within two years the expenditure in killing rats ceased almost entirely, and in another year I enjoyed relief and immunity; and ever since the losses from rats have been a mere trifle. Within a very short time (three years) neighboring estates found a similar benefit, and some of my brother sugar planters, who had laughed at me for supposing the mongoose would do any good, began to buy all they could procure from the natives, who, setting traps on my lands, stole all the mongooses

they could obtain, and sold them. By this means, and naturally, the mongoose has become general all over the island, and the beneficial results of this useful animal may safely be taken as exceeding £150,000 a year." The mongoose has been subsequently introduced with equally satisfactory results, into Cuba, Porto Rico, Grenada, Barbadoes, and Santa Cruz.

The small Indian mongoose (*H. auropunctatus*) is a member of the same group as the preceding species, but is of smaller dimensions, with closer and shorter fur, in which the individual hairs of the back do not have more than five colored rings. This is a northern form not found in India to the southward of Calcutta, and ranging into the Himalayas as far north as the valley of Kashmir, while to the westward its range includes Baluchistan and portions of Afghanistan and Persia, and eastward it extends through Assam into Upper Burma. In Kashmir it may frequently be seen in the Mohammedan burying places, where it inhabits old graves. Omitting



THE CRAB-EATING MUNGOOSE.
(One-sixth natural size.)

mention of other uniformly-colored Indian species, we may briefly refer to three other species inhabiting our eastern dominions. One of these is the ruddy mongoose (*H. smithi*), widely distributed in India, and distinguished by the black tip to its tail, and the absence of a stripe on the throat. The second is the striped-necked mongoose (*H. viticollis*), which is the largest of all the Asiatic species, and is readily distinguished by having both a black tip to the tail and a black stripe down each side of the neck. It inhabits Western India, from Bombay to Cape Comorin, and is also found in Ceylon.

The last of these three species is the crab-eating mongoose (*H. urva*), remarkable on account of its peculiar habits. In size this species (of which we give a figure) is rather smaller than the preceding one, and is characterized by its thick and heavy build, the uniformly-colored tail, and the presence of a narrow white stripe running along each side of the neck, from the angle of the mouth to the shoulder. The crab-eating mongoose is found at low elevations in the Southeastern Himalayas, as well as in Assam, Arakan, Pegu, Tenasserim, and the south of China. It is stated to be of partially aquatic habits, and derives its name from the crabs which, together with frogs, are asserted to form its chief food. Further information as to the habits of this species is, however, still required.

The remaining representatives of the true mongooses comprise the large Javan mongoose (*H. javanicus*) and the short-tailed mongoose (*H. brachyurus*) from the Malay Peninsula and some of the islands of the same region, and the barred mongoose (*H. semitorquatus*) from the island of Borneo. It has already been mentioned that a few of the true mongooses have but three premolar teeth on either side of each jaw; such species being found only in Africa. It may be added that in these species there is always a distinct gap between the tusk or canine tooth and the premolar corresponding with the second in those species having four of these teeth. There occur, however, in Africa two small mongooses with only three premolar teeth, of which the most anterior is placed close up to the tusk, so that there is no gap in the series. These species are also distinguished from their African relatives by their proportionately shorter tails, of which the length is less than that of the body alone. Hence these two animals have been referred to a distinct genus—*Helogale*. Of the two species, the one named *H. parvula* is an inhabitant of Natal, and is of a grayish-brown color; while the other—*H. undulata*—hails from East Africa, in the Mozambique district, and has the hair of a grizzled rufous tint. Both have naked soles to the hind-feet.

THE FOUR-TOED MUNGOOSES

Genera *Cynictis* and *Bdeogale*

In describing the typical mongooses it was mentioned that the first toes in both fore and hind-feet are of extremely small size. It might have been added that this small size of the first toe is more marked in the hind than in the fore-feet, and that in both limbs these digits appear to be of no functional use. We have now to mention three African mongooses in which this small first toe disappears either in the hind-limb alone or in both hind and fore-limbs. The whole of these species have four premolar teeth on either side of each jaw, and are further characterized by the hairiness of the soles of the hind-feet.

The thick-tailed mongoose (*Cynictis penicillata*) is the only representative of its genus which is characterized by having four toes on the hind-foot and five on the fore-foot. This animal inhabits the Cape Colony, and is of medium size. It may be readily distinguished from all its allies by its bushy, white-tipped tail, and the peculiar grayish-yellow color of its fur, which is liable to some degree of individual

variation. The other two species (*Bdeogale crassicauda* and *B. puisa*) are from East Africa,—Mozambique and Zanzibar,—and are distinguished by having but four toes on both fore and hind-feet. Both species are closely allied, differing mainly in the color of the hairs of the tail.

THE SMOOTH-NOSED MUNGOOSES

Genera *Rhinogale* and *Crossarchus*

The remaining members of the mongoose group, all of which are African, differ from the whole of the preceding in that there is no median vertical groove between



THE THICK-TAILED MUNGOOSE.
(One-eighth natural size.)

the nose and the upper lip. They are referred to three distinct genera, of which the two here mentioned have five toes on each foot.

Meller's mongoose (*Rhinogale melleri*) is an East African species, which is of interest not only on account of its being the sole representative of the genus to which it belongs, but also from only a single specimen (described as long ago as 1864) having hitherto been obtained of it. It is of about the same form and size as the Egyptian mongoose, with the full number of premolar teeth, and with the soles of the hind-feet completely covered with hair, as far as the roots of the toes. The tail is about equal in length to the body, and the general color is a uniform pale

brown, becoming lighter on the head, the individual hairs having but one or two rings of different colors.

The four remaining mongooses to be mentioned under this heading collectively constitute the genus *Crossarchus*, which is distinguished from the preceding by having only three premolar teeth on either side of each jaw, and likewise by the under surface of the hind-feet being completely naked. A further distinction between the two is to be found in the circumstances that, while in Meller's mongoose the palate of the skull is concave, in the members of the present genus it is completely flat. All are of burrowing habits.

Of the four species, the cusimanse (*C. obscurus*), ranging in West Africa from the Camerun mountains to Sierra Leone, and the Gambian mongoose (*C. gam-*



THE CUSIMANSE.
(One-fourth natural size.)

bianus) of the Gambia have uniformly-colored and grizzled fur. The former, which is figured above, is of a dull brown color, with yellow tips to the hairs, while the latter is gray, with the hairs ringed. On the other hand, the East African species, namely, the zebra mongoose (*C. zebra*) and the banded mongoose (*C. fasciatus*), have the back banded with transverse stripes, which are narrow in the former and broad in the latter, as shown in the illustration on the next page. The zebra mongoose, which is confined to Abyssinia, is further distinguished by the rufous color of the under parts; while in the banded mongoose, of which the range extends from the eastern portion of the Cape Colony to Mozambique, the color of the under surface of the body is grizzled gray.



THE BANDED MUNGOOSE.
(One-sixth natural size.)

THE MEERKAT

Genus *Suricata*

The meerkat of the Cape Colonists, or suricate as it is frequently called by zoologists (*Suricata tetradactyla*), while agreeing with the two genera last mentioned in the absence of a groove below the nose, differs from both in having but four toes on each foot. It is further characterized by having three premolar teeth on each side of the upper jaw, and four on the lower jaw, so that the total number of teeth is thirty-six. The soles of the hind-feet are naked.

The meerkat is a small animal of slender form, with a tail of about half the length of the head and body. The fur is long and soft, of a light grizzled gray color, with black transverse stripes across the hinder part of the back, the under parts rufous, the head nearly white (except a black mark round the eyes), the ears black, and the tail yellowish, with a black tip. The longer hairs are broadly ringed with black and white, the white predominating. The transverse light and dark bands on the loins are formed, according to Mr. O. Thomas, by the regular arrangement of the hairs, by which the white and black rings come opposite to each other on adjacent hairs. The same writer observes that meerkats may be distinguished at a glance from all other mongooses by their elongated nose and claws, as well as by their peculiar coloration, no other species having ears differing in color from the rest of the head.

Meerkats appear to be confined to the Cape Colony, extending at least as far north as Algoa Bay. In regard to their habits, we may quote from Mrs. A. Martin,

who, in her work entitled *Home Life on an Ostrich Farm*, states that these animals form most admirable and amusing little pets, nearly every homestead on the Karru having one or more of these creatures. In their wild state the meerkats live in colonies or warrens, burrowing deep holes in the sandy soil, and "feeding chiefly on succulent bulbs, which they scratch up with the long, curved, black claws on their fore-feet. They are devoted sun-worshippers, and in the early morning, before it is daylight, they emerge from their burrows, and wait in rows till their divinity appears, when they bask joyfully in his beams. They are very numerous on the Karru, and, as you ride or drive along through the *veldt*, you often come upon little colonies of them sitting up sunning themselves, and looking, in their quaint and pretty favorite attitude, like tiny dogs begging. As you approach they look at you



THE MEERKAT.
(One-fourth natural size.)

fearlessly and impudently, allowing you to come quite close ; then, when their confiding manner has tempted you to get down in the wild hope of catching one of them, suddenly all pop so swiftly into their little holes that they seem to have disappeared by magic."

Although in the Cape it appears that the name meerkat is also often applied to the thick-tailed mungoose (*Cynictis*), it is the true meerkat alone which makes such a charming pet. "The quaint, old-fashioned little fellow," continues Mrs. Martin, "is as neatly made as a small bird ; his coat, of the softest fur, with markings not unlike those of a tabby cat, is always well kept and spotlessly clean ; his tiny feet, ears, and nose are all most daintily and delicately finished off ; and the broad circle

of black bordering his large dark eye serves, like the antimony of an Egyptian beauty, to enhance the size and brilliancy of the orbs. A curious kind of seam, starting from the middle of his chin and running underneath him along the whole length of his body, gives him somewhat the appearance of a stuffed animal which has not been very carefully sewed up. His bright, pretty little face is capable of assuming the greatest variety of expressions, that which it most frequently wears when in repose being a contented, self-satisfied smirk ; impudence and independence displaying themselves at every line of his plump little figure. . . . He is absolutely without fear, and with consummate coolness and audacity will walk up to the largest and most forbidding-looking dog, although a perfect stranger to him, and, carefully investigating the stranger on all sides with great curiosity, express disgust and defiance in a succession of little short sharp barks."

Meerkats seem to have, indeed, a remarkable affection for dogs, and, when tamed, will follow these animals for long distances, trotting contentedly along in their wake in the same manner as a dog follows his master. Like most of the civet tribe, when tamed, the meerkat is an inveterate thief.

THE MADAGASCAR MUNGOOSES

Genera *Galidictis*, *Eupleres*, etc.

It will be convenient to allude, under the name of mongooses, to certain very curious members of the civet tribe which inhabit the island of Madagascar. These are arranged under four distinct genera, of which the first three are nearly allied to one another, and are also related to the African mongooses, while the fourth is very different from both, and is indeed an altogether aberrant modification of the family. Most of these creatures have no recognized English titles, so that we are compelled to mention them under their scientific names.

The munguste (*Galidictis striata*) is one of two nearly-allied species characterized by having the ground color of the fur of a light tint, marked by longitudinal dark stripes on the body ; this peculiar coloration being alone quite sufficient to distinguish these animals from all their allies. The munguste measures about twelve and one-half inches in length, exclusive of the tail ; the latter being rather shorter than the head and body. The tail is bushy in both species, and the claws are longer than in the true mongooses. In the munguste the snout is rather short, but it is more elongated in the other species (*G. vittata*).

The galidia (*Galidia elegans*), which is the only representative of its genus, differs from the munguste in having the fur of the body uniformly colored ; but the tail is ringed with black bands, the individual hairs being of one color throughout their length. The hemigalidia (*Hemigalidia olivacea*) differs from it by the tail being of the same uniform coloration as the head and body, and also in its more pointed muzzle, and the smaller curvature of the claws.

The most remarkable of these four types of Madagascar Carnivores is however, the *Eupleres goudoti* ; its most peculiar characteristic being the very small size of the teeth and the weakness of the jaws. The teeth, of which the number is the same as

in the civets (forty) are, indeed, much more like those of an Insectivore than of a Carnivore, most of them being separated from one another by spaces; the tusks or canines are not longer than the front teeth, and the flesh-tooth is scarcely distinguishable from the adjacent teeth. The length of the head and body of the eupleres is about nineteen and one-half inches, the tail being about one-third of this length. The body is covered with a uniformly-colored woolly fur, of which the general tint is olive, finely speckled with yellow; this speckled appearance being due to the individual hairs being banded with differently-colored rings. The ears are large, the short tail is bushy, the feet, which are furnished with five toes, are remarkable for their extreme slenderness, and the claws are long and like those of the mungoses. In the young eupleres the fur of the shoulders has black transverse stripes. It does not appear that anything is known of the habits of this rare, and doubtless nocturnal creature, but the weakness of its teeth and jaws suggests that its food consists rather of insects than of flesh.

EXTINCT CIVET-LIKE ANIMALS

It has been mentioned under the heading of the true civets, that remains of species belonging to that group are found low down in the Tertiary series of Europe. It may be added here that remains of mungoses, which have been referred to the typical genus *Herpestes*, are also found in these same upper Eocene and lower Miocene rocks of France. There also occur the bones and teeth of other animals more nearly allied to the linsangs; while others, again, appear to connect the civets with the weasels—a connection which would have been wholly unsuspected if science had only existing animals to deal with. In a later geological epoch—namely the lower part of the Pliocene—there occurs another interesting type known as the *ictithere*, which serves so completely to connect the civets with the hyænas as to prove conclusively the close alliance of these two families of Carnivores. Before, however, proceeding to the hyænas, we must first take into consideration

THE AARD-WOLF

Family *PROTELEIDÆ*

Genus *Proteles*

The remarkable creature known to the Dutch boers of South Africa as the aard-wolf is one of those animals which have long been a puzzle to zoologists. It is evidently allied in many respects to the hyænas, but in others it is so different that it becomes a matter of exceeding difficulty to decide if it should be included in the same family. The majority of English zoologists appear, however, to be inclined to regard the aard-wolf (*Proteles cristatus*) as the solitary representative of a distinct family.

In size it has been compared to a large and "leggy" fox; while, in external appearance, the aard-wolf (which is known to the Kaffirs as the *isidawane*) some-

what resembles a rather small and thin-bodied striped hyæna, but it has longer ears and a more pointed muzzle. The fur, which is inclined to be shaggy and of a woolly nature, is of a yellowish or reddish-brown color, marked, with about half a dozen transverse black stripes on the sides of the body; and there may also be some dark bars on the limbs. The long tail is thickly haired. The long hair on the back forms a kind of crest (giving origin to the second scientific name of the aard-wolf), which can be erected at the will of the animal. The claws like those of the hyænas, are not capable of retraction, and are rather long, with blunted extremities. Whereas, however, the hyænas have but four toes on both the front and hind-feet,

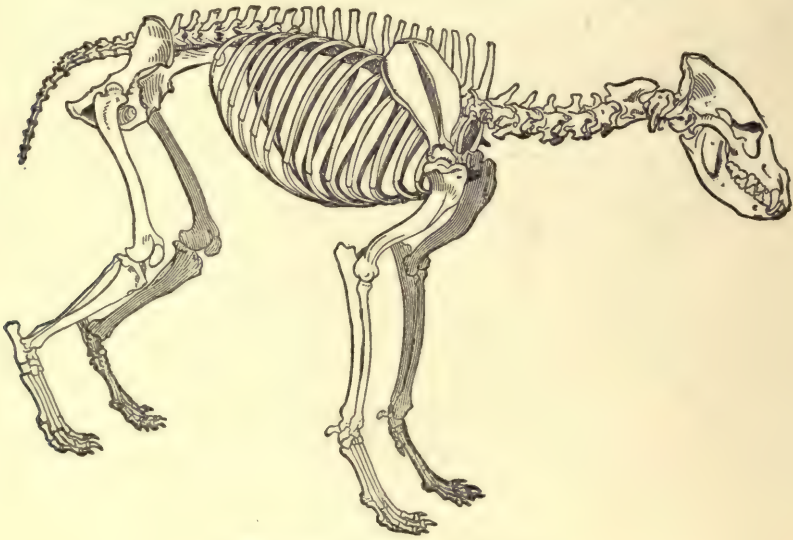


THE AARD-WOLF.
(One-seventh natural size.)

the aard-wolf has five toes on the front, and four on the hind-feet. But the most peculiar feature is to be found in the almost rudimental condition of the teeth, which may be either thirty or thirty-two in number, their small size being most apparent in those of the cheek series, which are widely separated from one another, and are quite unlike the strongly-developed teeth of the hyænas. The skull, while agreeing in many respects with that of the hyænas, has also certain points of resemblance with that of the mungooses. The aard-wolf may, in short, be regarded as an animal which, in all probability, originated from the same ancestral civet-like

creatures from which the hyænas were derived, but which has undergone a kind of retrograde development to suit the needs of a particular mode of life. It was long thought to be confined to South Africa, but it has been subsequently found to range on the West Coast as far north as Angola, and quite recently a single skin has been obtained from Somaliland, so that it probably extends right across the continent.

According to the accounts of all travelers through the Cape districts, it appears to be a comparatively rare animal, although this apparent rarity is doubtless, in some degree, due to its purely nocturnal habits. As its name implies, it lives in burrows, which are made by itself; and, according to the account of the traveler De Lalande, several individuals may inhabit one and the same burrow, which has generally at least two or three exits. Like all burrowing animals, it is of a timid and cowardly disposition, and, when driven from its burrow, makes off at a rapid pace. The aborted condition of the teeth would alone suffice to indicate that it subsisted on a diet different from that of ordinary Carnivores; and that such is really the case has been proved by observations made upon both wild and captive specimens. In the wild state it appears that its chief food consists partly of carrion and partly of the so-called white ants, or termites, which are dug out of their hills with its strong claws.



SKELETON OF SPOTTED HYÆNA.

THE HYÆNAS

Family *HYÆNIDÆ*

In our notice of the lion, it was mentioned that there was considerable diversity of opinion as to his character and bearing; but no such uncertainty exists with regard to the hyæna, which, by common consent, is skulking, cowardly, treacherous, and cruel; and, so far as we are aware, no one has ever had a good word to say for him.

A GATHERING OF STRIPED HYÆNAS.

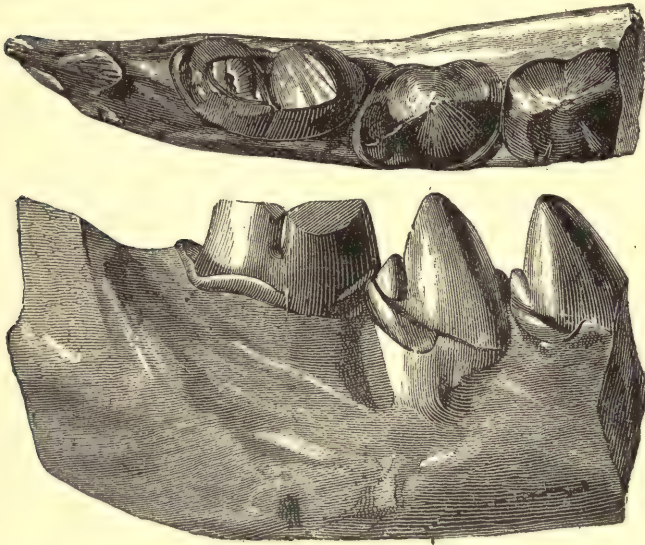


Like all the animals described in the present chapter, hyænas are confined to the warmer parts of the Old World; but unlike the civets, they are unknown at the present day in Europe and in the countries lying to the eastward of the Bay of Bengal; although, in past epochs, they were spread over the greater part of Europe, and ranged as far east as China. At no period, however, was the group represented in the Western Hemisphere.

The existing species of hyænas are three in number, all of them being now generally included in the single genus *Hyæna*; this genus forming the sole representative of a distinct family. With the exception of the aard-wolf, the nearest relatives of the hyænas are the civets; but at the present day the two families are markedly distinct, although, as mentioned on p. 484, extinct forms blend the two so closely together that it is almost impossible to say where civets end and hyænas begin. Hyænas are massively-built animals, with relatively-long legs,—especially the front pair,—deep bodies, short and broad heads, and rather short tails; their whole appearance being ungainly in the extreme. Their fur is coarse

and shaggy, and marked, more or less distinctly, either with irregular vertical stripes or large blackish spots. Their feet have but four toes, on both the front and hind-limbs, and are furnished with stout claws, which are permanently protruded, like those of dogs.

Such are some of their chief external characteristics; but in order to understand their full differences from the civet tribe, it is necessary to say something with regard to their teeth. Existing hyænas have a total of thirty-four teeth, of which $\frac{2}{3}$ are incisors, $\frac{1}{3}$ canines, $\frac{4}{3}$ premolars, and $\frac{1}{3}$ molars on either side of the jaws. Thus there is but one tooth, which is of small size, behind the flesh-tooth in the upper jaw, while in the lower jaw, as shown in the accompanying figure, the flesh-tooth forms the last of the series. Here, therefore, we have an important difference from the civets,—with the single exception of the fossa (p. 454), which is otherwise well distinguished,—most of these having two molar teeth behind the upper flesh-tooth, and the whole of them having one molar behind the lower flesh-tooth. This, however, is not all, for, whereas the civet family (always excepting the fossa) have only two



UPPER AND OUTER VIEWS OF THE HINDER PART OF THE RIGHT HALF OF THE LOWER JAW OF AN EXTINCT HYÆNA.

The tooth on the left side of the figure is the flesh-tooth. (From the *Palæontologica Indica*.)

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lobes to the blade of the upper flesh-tooth (see figure on p. 454), in the hyænas the same tooth (of which a figure is given on p. 356) has a three-lobed blade like that of the cats. Then, again, the lower flesh-tooth, as shown on the left side of the figure on p. 488, is also quite unlike that of a civet, and closely resembles that of a cat, the only well-marked difference being the presence of a larger or smaller heel at the hinder end, although in two of the living species it has also an additional cusp on the inner side of the cutting blade. This curious resemblance of the flesh-teeth of the hyænas to those of the cats, it may be remarked in passing, is an instance of what evolutionists now call *parallelism* in development; that is to say, the resemblance has been acquired independently in the two families, since it is certain that cats are not descended from hyænas, while it is even more obvious that hyænas are not the descendants of cats.

This resemblance of the teeth of the hyænas to those of the cats is, however, confined to the flesh-teeth. Thus, in place of having but two premolar teeth in each jaw in front of the flesh-tooth, the hyænas have three of these teeth in both the upper and the lower jaw between the flesh-tooth and the canine tooth. Moreover, these premolar teeth, in place of being much compressed from side to side like those of the cats, have nearly conical and very tall crowns, as is well shown in the figure on p. 488. These strong conical premolar teeth, which are strengthened by small fore-and-aft tubercles at the base, form crushing instruments of immense power; and it is due to these teeth, aided by the flesh-teeth and the tusks, that a hyæna is able to crunch in its jaws the shin bone of an ox almost as readily as a dog can break that of a fowl. Indeed, no carnivorous animal has jaws and teeth which can be compared for strength and bone-crushing power with those of hyænas.

THE STRIPED HYÆNA (*Hyæna striata*)

The striped hyæna, which is the only representative of the genus found in India, is one of the two smaller and less powerful species, the length of the head and body measuring three and one-half feet, and that of the tail one foot six inches. The species is characterized by its large and pointed ears, by the presence of a crest or mane of long hairs running along the middle of the neck and back, and by the long hair clothing the tail, as well as by the relatively-small size of the hind, as compared with the fore-feet. In color the striped hyæna is dirty gray, with narrow transverse tawny or blackish stripes on the body and legs.

If the skull be examined, it will be found that the lower flesh-tooth differs from that of the jaw represented in the figure on p. 488, by the greater size of the heel at its hinder base, while on the inner side of the blade of the same tooth there is a small conical cusp which does not appear in the figured jaw. Moreover, in the upper jaw, the molar tooth occurring behind, or rather to the inner side of, the flesh-tooth, has a somewhat large crown, elongated in the transverse direction. In these respects the striped hyæna is less widely removed from the civets than is its cousin the spotted hyæna, and it is also somewhat less powerful in its jaws and teeth.

The striped hyæna is found throughout India, being especially common in the Northwest and Central Provinces ; but it is unknown in Ceylon. From India its range extends westward through Baluchistan into Persia and Mesopotamia, as far as the Caucasus. It is also common in Palestine, Syria, and Arabia ; and the present writer on one occasion saw from the deck of a P. and O. steamer one of these animals walking on the Syrian side of the Suez canal. From Syria it extends into Northern Africa, where it is occasionally met with in Abyssinia, but is more common in Egypt, and also to the westward in the regions lying to the north of the Sahara desert. Quite recently Dr. Emin Pasha, writing from Tabora, in East Africa, stated that a striped hyæna, similar to, and perhaps identical with, the Egyptian form, but smaller and lighter in color, occurred in that part of Africa. During and before the age of the mammoth, the striped hyæna wandered over a considerable part of Europe, its remains having been discovered in a cave in the south of France ; while teeth have also been obtained in England. It was, however, far less common in Europe than the spotted species.

Both in India and Syria the striped hyæna frequents open hilly or sandy districts ; although in the former country it is occasionally met with in forests, and, according to Canon Tristram, in the latter it may be found both in the deserts and in the woods. Like the other species it is nocturnal, although a stray individual (as the one above referred to) may be occasionally seen in the daytime, more especially in the early morning or late in the evening ; but the striped hyæna differs from the spotted species in being a comparatively solitary animal, it being rare to meet with more than two together.

In Syria and Palestine the favorite haunts of the striped hyæna are the rock-cut tombs so common in these countries ; but in India it is more commonly found in holes and caves in rocks. Dr. Jerdon, writing of this species, says, that " I have more than once turned one out of a sugar cane field when looking for jackals, and it very commonly lurks among ruins ; but in general its den is in a hole dug by itself on the side of a hill or ravine, or a cave in a rock. The call of the hyæna is a very disagreeable unearthly cry, and dogs are often tempted out by it when near, and fall a victim to the stealthy marauder. On one occasion a small dog belonging to an officer was taken by a hyæna very early in the morning. The den of this beast was known to be not far off in some sandstone cliffs, and some sepoy of the detachment went after it, entered the cave, killed the hyæna, and recovered the dog alive, with but little damage done to it. A hyæna, though it does not appear to move very fast, gets over rough ground in a wonderful manner, and it takes a good long run to overtake it on horseback, unless in most favorable ground. A stray hyæna is now and then met with by a party of sportsmen, followed and speared ; but sometimes not till after a run of three or four miles, if the ground is broken by ravines. It is a cowardly animal, and shows but little fight when brought to bay. The young are very tamable, and show great signs of attachment to their owner, in spite of all that has been written about the untamable ferocity of the hyæna." According to Mr. Blandford, the striped hyæna is a more silent animal than its spotted cousin ; and the cries of the two species, though in some respects similar, are very different.

The striped hyæna's food is mainly carrion or carcasses killed by other animals ; and in inhabited districts the animal is much dreaded on account of its grave-robbing propensities. Portions of such carcasses as it finds are eaten on the spot, while other parts are dragged off to its den, the situation of which is generally indicated by the fragments of bones around the entrance. These hyænas will also feast on skeletons that have been picked down to the bone by jackals and vultures ;



THE BROWN HYÆNA.
(One-twelfth natural size.)

the bone-cracking power of the hyæna's jaws rendering such relics acceptable, if not favorite food.

The striped hyæna, will not unfrequently carry off sheep and goats as well as dogs. Mr. Blanford states that he has never known instances of larger prey being taken ; and he supports this statement by mentioning that the live animals, tied up so frequently as baits for tigers and leopards, are never molested by hyænas, which

are undoubtedly in the constant habit of banqueting on carcasses of animals killed by those cats. Canon Tristram relates, however, that in Palestine a donkey belonging to one of his servants was killed by a hyæna while the owner was sleeping alongside.

The striped hyæna — probably on account of its “body snatching” propensities — is cordially detested by the natives of all the countries it inhabits. When a hyæna is killed, the body is treated in many parts of India with every mark of indignity, and finally burned. On one occasion in the Punjab the present writer came across a party of natives cruelly ill treating a nearly full-grown hyæna, which had been rendered helpless by its jaws being muzzled and its feet broken. Needless to say the sufferings of the poor brute were soon terminated by a bullet. Although, owing to their nocturnal habits, hyænas are seldom seen, yet in some parts of India, from the multitude of their tracks, they must be very common. These tracks, as Mr. Blanford observes, are like those of a dog, from which they may, however be distinguished by the small size of the prints of the hind as compared with those of the fore-feet.

THE BROWN HYÆNA (*Hyæna brunnea*)

The brown hyæna is far less well known than either of the other living species. Although in most respects more nearly allied to the striped hyæna, it exhibits some points of affinity with the spotted species. It is characterized by the long mantle of coarse hair, depending from the neck and back, and reaching below the belly, as is well shown in our illustration on p. 491. The ears are long and pointed, and the tail is short and bushy. The general color of the long hair is uniform dark brown, with lighter brown or whitish patches on the legs; while the head is dark grayish brown, and the forehead black, sprinkled with whitish or reddish brown. The long hair of the back is whitish gray at the root, and blackish brown above. The legs are striped. In size this species is about the same as the striped hyæna.

The brown hyæna is a South African species, ranging on the East Coast as far as Kilima-njaro, while on the west side it may extend as far north as Mossamedes. It does not ever appear to be found at any great distance from the coast. It is doubtless this species, referred to by Mr. H. H. Johnston as the striped hyæna, which is common on the flanks of the Kilima-njaro, up which it ascends to a considerable elevation; the spotted hyæna being confined to the plains. In its preference for rocky spots in that district it, therefore, resembles the striped hyæna.

THE SPOTTED HYÆNA (*Hyæna crocuta*)

The African spotted hyæna is by far the largest and most powerful of the three living species, differing from the others not only in several structural features, but also by its habit of associating in packs, and of giving utterance more frequently to its unearthly cry.

Externally the spotted hyæna is distinguished by its rounded and moderate-sized ears, by the absence of a crest of long hairs along the neck and back, and the

shorter and less hairy tail. Moreover, the hind-feet are relatively larger in proportion to the fore-feet, and the front and hind-legs are more nearly equal in length; the hind-limbs being less bent than in the other species. The ground color of the fur of the body is yellowish, and upon it are dark-brown spots; the front of the face and the lower portions of the limbs being also dark.

In addition to certain structural features of the soft parts, into the consideration of which it would be out of place to enter here, the spotted hyæna is distinguished by the characteristics of its teeth. As these have been already partially described (p. 489), it will suffice to mention that the upper molar tooth, situated on



THE SPOTTED HYÆNA.
(One-eleventh natural size.)

the inner side of the exceedingly elongated flesh-tooth, has a very small and nearly round crown, and that it is inserted only by a single root, whereas the corresponding tooth of the striped species has two distinct roots. Then, again, the lower flesh-tooth resembles that of the jaw figured on p. 488, in the small size of its posterior heel, and also in the absence of a cusp on the inner side of the blade.

Owing to the disproportion in the length of the hind and fore-legs being much less than in the striped hyæna, the gait of the spotted hyæna is far less ungainly and awkward looking.

The spotted hyæna occurs throughout Africa south of the Sahara, ranging on the eastern side of the continent into Abyssinia and Nubia. At one time it was very abundant in the Cape Colony, and Sir Samuel Baker bears testimony as to its numbers on the Upper Nile in the neighborhood of Kassala, while Mr. H. H. Johnston attests its common occurrence on the plains around Kilima-njaro. Formerly, however, the geographical range of this hyæna was far more extensive than it is at present, as is proved by the vast quantities of its remains found in the caves of various parts of Europe, from Gibraltar in the south to Yorkshire in the north. It was formerly considered, that the so-called "cave-hyæna" indicated a distinct species from the living one; but zoologists are now generally in accord in regarding the two as specifically identical, although the fossil European hyænas were generally of larger dimensions than the existing African form. Moreover, a single lower flesh-tooth obtained from a cavern in Madras points to the conclusion that the range of this species at one time also embraced the southern part of India.

When the spotted hyæna was an inhabitant of the vales of Yorkshire and of the Mendip hills the climate of Britain must have been very different from what it is now, it being impossible to believe that an animal now restricted to Africa could have withstood the rigors of the present winters. That the British spotted hyænas of the cave period were not mere summer stragglers from the south is amply shown by the quantities of their remains which are found in some of the caves. Such caverns were veritable hyæna dens, where the animals must have lived from year's end to year's end, and from generation to generation.

The spotted hyæna is a far fiercer and more aggressive animal than his Indian relative. During the Abyssinian campaign, Mr. Blanford states that these animals constantly came among the tents at night, and would at times attack the mules, ponies, cattle, and goats tethered near the camp. In that part of the country the hyænas are stated to be as common in the highlands as in the lowlands; although, as already mentioned, this does not appear to be the case in the Kilima-njaro district, where Mr. Johnston observes that not only do they steal sheep and calves from the herds, but they even carry off children, and often attack wounded and weakly men. "I once," continues Mr. Johnston, "sent a sick man back to the coast a short distance by himself, and he was severely bitten at night by the hyænas. He succeeded, however, in beating them off, and recovered from his wounds."

Sir Samuel Baker describes the midnight visit of a hyæna to his tent, when on the Upper Nile, in the following words: "I was asleep in my tent, when I was suddenly awakened by a slight pull at my sleeve, which was the signal always given by my wife if anything was wrong. . . . She now whispered that a hyæna had been within the tent, but that it had just bolted out, as these animals are so wary that they detect the slightest movement or noise. As a rule, I never shoot at hyænas, but, as I feared it might eat our saddles, I lay in bed with the rifle to my shoulder, pointed toward the tent door through which the moon was shining brightly. In a few minutes a gray-looking object stood like an apparition at the entrance, peering into the tent to see if all were right before it entered. I touched the trigger, and the hyæna fell dead."

The Hon. W. H. Drummond, referring to the spotted hyæna of Southeastern Africa, notices the damage these animals do to cattle, more especially cows; and then mentions certain instances where they have attacked human beings. "Cowardly when there is the faintest suspicion of danger, daring when there is none, stealthy and cunning to the last degree, and provided with great powers of scent and hearing, added to immense strength, there is no animal so universally hated, or that causes more trouble and annoyance to both hunters and the peaceful natives." Common as they are in Southeastern Africa, spotted hyænas are, however, but very seldom seen, as they are quite as nocturnal as their striped cousin, retiring to their holes at the earliest dawn. "Regular beaten paths," he continues, "lead to these burrows, along which they invariably go, both when coming out and returning; indeed, unless they scent food, they always make use of paths in their nocturnal rambles, whether made by themselves or by men or game. In a primitive state there is no doubt that they are chiefly dependent upon the lion for their daily food, and it is equally certain that they must be able to go without eating for immense periods. The old hunters declare that their numbers have much increased within their memory in the districts in which there is most hunting, and as so much game goes away and dies unseen of its wounds, which the hyænas are easily able to find by the blood track which they leave, to say nothing of the amount of meat that is purposely left for want of a use for it, there is every reason to think that they must find man a better purveyor than the lion, and increase accordingly."

EXTINCT HYÆNAS

The occurrence of fossil remains of the spotted and striped hyænas in the caverns and other superficial deposits of Europe has been already mentioned. In the antecedent Pliocene period there were, however, a number of hyænas belonging to species now extinct; some of these being nearly allied to the existing forms, while others differed markedly in the number and characteristics of their teeth. These extinct hyænas are found over the greater part of Europe—from France to Italy, Greece, and Hungary—and also in Persia, India, and China. Colvin's hyæna from Northern India, of which a portion of the lower jaw is figured on p. 488, and the robust hyæna of Italy were nearly allied to the spotted species, while the Pikermi hyæna of Greece differed from all living species in having four premolar teeth in the lower jaw. The Siwalik hyæna of Northern India and the Grecian hyæna were allied to the striped species, but both have an additional molar behind the lower flesh-tooth, while the former has four lower premolars. Again, the long-jawed hyæna from Northern India and a nearly-allied species from Greece differ from existing forms in their long jaws and the compressed form of the premolar teeth, of which there were four in the lower jaw. These two species make a marked approach to the civets, but this is still more evident in a smaller extinct hyæna from Europe, referred to a distinct genus under the name of *Palhyæna*. In this there were four premolar and two molar teeth in each jaw, so that the total number of teeth was forty, or the same as in the true civets, and this extinct species was so nearly allied to the extinct civet mentioned on p. 484 as the ictithere, that the two families may be regarded as passing one into the other.

CHAPTER XV

CARNIVORES—*continued*

THE DOG TRIBE

Family *CANIDÆ*

UNDER the general title of Dogs may be included all the animals commonly known as wolves, jackals, foxes, and wild dogs, together with the various breeds of domestic dogs. These collectively constitute the family *Canidæ*, and form a group in some respects intermediate between the Carnivores treated in the two preceding chapters, and those described in the three succeeding ones. The Dog family must always have an especial interest, since it includes the animals which have become more thoroughly the friends and companions of man than any other creatures. The origin of the domestic dogs is, however, shrouded in the mist of antiquity, and it is still an open question whether the various breeds are descended from a single wild stock, or whether they are the product of several species.

The Dog family, as thus constituted, forms, at the present day, a compact and well-defined group, the wild members of which cannot be confused with those of any other. The whole of them are characterized by their long and pointed muzzles, their moderately long tails, and their perfectly digitigrade feet furnished with blunt, nearly straight, and nonretractile claws. Then, again, all the dogs have but four toes on the hind-feet, while, with the exception of the African hunting-dog, the number of toes on the fore-feet is five, of which the first, or innermost, is shorter than either of the others, and does not touch the ground. The limbs, although varying in relative length, are never so short in proportion to the body as is the case in so many of the Civet family. The ears are pointed and erect, but vary greatly in length in the different groups. Such are some of the chief external characteristics of the dogs, but, in order to understand their distinction from other families of Carnivores, it is essential to pay attention to the skull and teeth. In all the dogs the skull, as shown in the figure on p. 355, is characterized by its elongated muzzle and the large number of teeth with which it is furnished; in both of which respects it is widely different from the skull of the cats. On the under surface of the hinder part of the skull the tympanic bulla is inflated and bladder like, although it is not divided into two chambers by a complete septum. This part of the skull serves, therefore, to distinguish the dogs from the Carnivores yet mentioned, with the exception of the hyænas. From the hyænas, as well as from the cats, the dogs are readily distinguished by the number and structure of their teeth. With but few exceptions, the total number of their teeth is forty-two, or two more than the true civets; the series consisting of $\frac{3}{2}$ incisors, $\frac{1}{1}$ canines, $\frac{4}{4}$ premolars, and $\frac{2}{2}$ molars.

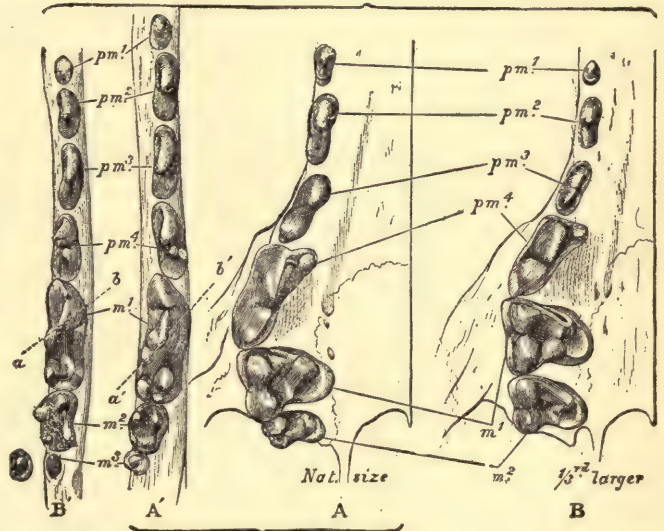
If this formula be compared with the one given on p. 454, it will be seen that the excess in the number of the teeth of a dog over those of a civet is owing to the presence of an additional pair of molars in the lower jaw. This will not, however, serve to distinguish between all the dogs and the civets, since the Indian wild dogs have but two pairs of lower molars. In all cases there are four premolar teeth on each side of both jaws. The cheek-teeth of the dogs are constructed on the same general plan as those of the civets, the upper flesh-tooth having but two lobes to the blade, while the lower flesh-tooth has a large heel posteriorly to the cutting blade; this heel being, however, relatively smaller than in the civets. In both dogs and civets, the molars of the upper jaw have the same general triangular form. A good idea of the characteristic of the cheek-teeth of the dogs will be gathered from the accompanying figure, while the skull represented on p. 355 shows the lateral aspect of the whole dental series.

There are other characteristics connected with the skull, together with many points in the structure of the soft parts, which afford additional means of distinguishing the dogs from other Carnivores, but the above are sufficient to define the group, so far as living forms are concerned.

In their general uniformity of structure and outward appearance, the

dogs differ widely from the civets, and more nearly resemble the cats. There is a considerable amount of difference in external appearance between a fox and a wolf, but intermediate forms connect them so closely that they are generally considered as members of a single genus. On the other hand, three members of the family differ so remarkably from all the rest, and also from one another, that they are regarded as the representatives of as many genera. Some diversity of opinion exists as to the advisability of also referring the Asiatic wild dogs to a distinct genus, but they are here classed in the typical genus *Canis*. We thus have the whole of the existing members of the family ranged under four genera, of which the last three are severally represented by a single species.

With the marked exception of the Cape hunting-dog, all the members of the family are characterized by their more or less uniform and sombre coloration; in



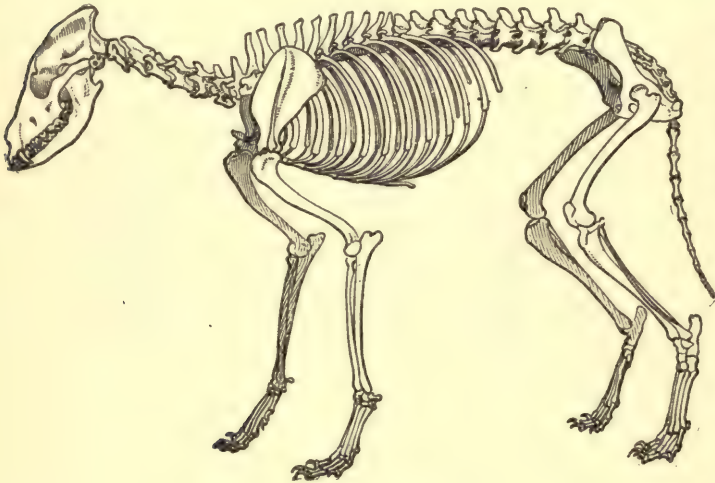
THE RIGHT UPPER AND LOWER CHEEK-TEETH OF THE COMMON FOX (A, A') AND OF AZARA'S FOX (B, B').

The letters *p. m. 1* to *p. m. 4* indicate the premolar, and *m. 1* to *m. 3* the molar teeth; *p. m. 4* in the upper and *m. 1* in the lower jaw, being the flesh-tooth. In *m. 1* of the lower jaw *b* indicates the hinder lobe of the cutting blade, and *a* its inner cusp. (After Huxley, *Proc. Zool. Soc.*)

which respect they are markedly different from both the civets and the coatis. The general coloration of the dogs varies from gray to a yellowish or reddish brown; the upper part of the head and back, as well as some portions of the limbs, being generally darker than the flanks, while the under parts are paler. The outer surfaces of the ears may be distinctly colored, and there is often a dark mark between the eye and the nose, and another near the tail; but, as a rule, stripes or patches differing in hue from the ground color of the fur are absent, or ill defined. In spite, however, of this general uniformity of coloration, many of the species are subject to an extraordinary amount of either individual or seasonal variation, both in respect to color, and also as regards the length of their fur. In consequence of such variations much uncertainty has prevailed as to the number of species. Professor Mivart gives the probable number as thirty-five, but he reckons a few forms which other writers do not consider entitled to rank as more than varieties, while some of the

forms which he considers to be varieties are regarded as species by others. The total number may, therefore, be roughly estimated at a little below forty.

As regards the seasonal and individual variation in the coloration of dogs, it may be observed that the hue of the fur is generally lighter in winter than in summer; this difference attaining



SKELETON OF WOLF.

its maximum in the Arctic fox, of which the usual winter pelage is pure white. Then again, among those species or races inhabiting high latitudes or mountains, the fur is considerably longer in winter than in summer. Moreover, as with the cats, some species show more or less marked tendencies to the development of black individuals. Again, and especially among the foxes, the color of different individuals or races of a single species may vary from a grayish, through a yellowish, to a reddish tinge; while, if the general color remains the same, there may be darker or lighter shades. Added to these variations in the coloration and length of the fur, there may also be a large amount of individual difference in point of size in the same species.

A peculiar characteristic of many dogs, and one in which they differ markedly from the cats, is their habit of associating in large packs for the purpose of hunting their prey. In general, such prey is pursued chiefly or entirely by the aid of smell, which attains an extraordinary development in some members of the group. This keen perception of scent is not, however, accompanied by any deficiencies in the

senses of sight and hearing, both of which are also highly developed. It is probably due to this habit of associating in packs that many of the dogs are, to a greater or smaller extent, diurnal; but the majority are also in part nocturnal. From the nature of their claws, no dogs are fitted for climbing trees; and none are especially adapted for an aquatic life, although several of the domestic breeds are excellent swimmers. The cry of the various species of wild dogs varies greatly, but may generally be termed a howl rather than a bark, although some utter a kind of yelping bark. Apparently, all the species can be tamed to a certain degree, although the extent to which this taming can be carried out varies in different species, and even in different individuals of the same species. All wild dogs are in the habit of living in burrows, in the clefts of rocks, in caverns, or hollow trees. Some species, like the fox, excavate burrows for themselves, while others take advantage of the deserted holes of other animals; and whereas some dogs dig solitary burrows, others excavate them close together, so as to form a colony, or warren. The number of young in a litter is said to vary from three to as many as a dozen; and it is believed that in all cases the cubs or "pups" are born blind. Several of the wild species, like the jackal and the wolf, will freely interbreed; and the hybrid offspring between either of these species and domestic dogs are known to be fertile.

As regards their geographical distribution, the dogs are more widely spread than any family of Carnivores yet noticed; and in this respect they are only approached by the weasel family. This wide distribution is the more remarkable when the uniformity in the organization and external appearance of the members of the group are taken into consideration. The great majority are to be found in the Northern Hemisphere, in which one is common to both Europe and North America. A single species, the dingo, is now found wild in Australia, but no wild dogs occur in either Ceylon or Madagascar.

In disposition and the nature of their food many of the dogs show marked differences. Thus, whereas the European wolf, which hunts in packs, and is exceedingly fierce, will attack both human beings and cattle, the solitary South American maned wolf is a timid and comparatively harmless animal, except to the small creatures upon which it preys. Again, whereas the majority of species are more or less purely carnivorous, and kill their own prey, the jackal lives largely upon carrion; while other species will devour lizards, mice, and even snails, and insects. Others, again, will eat marine mollusks and crustaceans, while the Arctic fox subsists largely upon fish, as does the domestic Eskimo dog.

As already mentioned, with the exception of three species, forming the types of as many genera, the whole of the existing members of the Dog family are included in the genus *Canis*. In all these forms there are five toes on the hind-feet; and, with the exception of the Asiatic wild dogs, there are three molar teeth on each side of the lower jaw.

THE WOLF (*Canis lupus*)

If we exclude some of the breeds of domestic dogs, the wolf is the largest living member of the family; and its reputation for fierceness is too well known to need

more than passing mention. It belongs to a group which includes the other wolves, the jackals, and the domestic dogs; all the wild species of which are characterized by their powerful teeth, the moderate brush formed by the tail (in which the hair is longer than that of the body), and by the pupil of the eye being round. Moreover, in the skull of all these animals the bony projection forming the hinder border of the socket of the eye is regularly curved downward and has a convex upper sur-



THE WOLF.
(One-ninth natural size.)

face; whereas in a fox the same process is hollow above, and has a more or less marked tendency to curve upward behind.

With the exception of the Antarctic wolf of the Falkland islands, true wolves are restricted to the Northern Hemisphere, being unknown both in Africa and South America. The European wolf measures about three and one-half feet in length, exclusive of the tail, and is characterized by having a woolly under-fur of a slaty-brown color. The prevailing hue of the fur is typically of a rufous or yellowish gray above, which may be more or less mingled with black; while the under parts

are whitish. The tail, which is considerably less than half the length of the head and body, may be tipped with black. From this ordinary type of coloration there may be variations, owing to the development of a more or less marked gray or red tinge; while in some cases the fur may be much paler than usual, and in others nearly or quite black. In Europe the light-colored varieties appear to be characteristic of northern, and the dark of southern regions, black or blackish wolves being not uncommon in Spain. As in Europe there is a black race of the ordinary wolf, so black specimens of the woolly variety occur in Tibet; these animals having shaggy fur of a uniform black color, except the muzzle, feet, and patch on the chest, which are white. More uncertainty has prevailed as to whether the Japanese wolf (*C. hodophylax*) is distinct from the European form; the Indian wolf is regarded, however, by Mr. Blandford (although not by Professor Mivart) as entitled to rank as a separate species.

The North American wolf has frequently been regarded as specifically distinct from the European one under the name of *C. occidentalis*. Dr. C. H. Merriam has, however, long regarded the two forms as specifically identical, and the same view is taken by Professor Mivart. The latter writer observes that although the fur of most American wolves is less red than is generally the case with European specimens, especially on the legs and the hinder part of the head, yet North European examples have a nearly similar coloration. Then again, the American skins generally have more black on the back than most European ones; but this tendency to blackness is still more marked in Spanish wolves. As in Europe, there is in America great individual and racial variation in the color of the wolf. Thus, according to Mr. S. F. Baird, there is a pure white wolf on the Upper Missouri, a dusky-blackish wolf on the Lower Missouri, a black wolf in Florida and the Southern United States, and a red wolf in Texas. There is, moreover, considerable difference in respect to size and shape; the southern wolves being smaller, more slender, and more "leggy" than those from the extreme north; while they have also shorter and closer fur. The southern limit of the wolf in America is the State of Guanajuato, in Mexico. Including, then, the whole of the varieties mentioned above, with the exception of the Indian wolf, under a single specific title, the range of the common wolf will be very extensive; and will embrace the whole of Europe, the greater part of Asia to the northward of the Himalayas, and as far east as Japan, and nearly the whole of North America.

In Europe the wolf has disappeared from Britain and Central and Northern Germany, but still lives in the wilder or more mountainous districts of the rest of the Continent, being especially abundant in many parts of Russia — both European and Asiatic. Wolves were formerly abundant in the British Islands; in Yorkshire they were common in the reign of Richard II.; while in the time of Cromwell parts of Ireland were much infested by them. Mr. Harting states that the wolf became extinct in England during the reign of Henry VII.; that it survived in Scotland until 1743; and that the last was killed in Ireland, according to Richardson, in 1770, or, according to Sir J. E. Tennent, subsequently to 1766.

In America, owing to the rapid spread of civilization, wolves are disappearing, or becoming scarce in all but the wilder districts. Professor Mivart, from data

supplied him by American naturalists, states that at the present day the wolf is found east of the Mississippi and south of Canada only in the still nearly unsettled parts of the country, as the northern portion of New England and New York, portions of the Alleghanies, Southern Florida, and possibly in the sparsely-settled parts of the interior states south of the Ohio. It is only abundant in the remote districts of Maine. West of the Mississippi its numbers are very small in comparison with its former abundance, while over vast areas it has been wholly extirpated.

Wolves inhabit both open country and forests; and although generally found in pairs, or solitary, they at times, and more especially in winter, associate in large numbers. They wander abroad both in the daytime and at night. Although usually cowardly, the wolf becomes bolder and more daring, stealing its prey by night, when driven by hunger, or when hunting together. Stories of the attacks of wolves, when in packs, upon travelers in Russia are so numerous, and have been so frequently quoted that it will be unnecessary to repeat any of them here; but it may be mentioned that in the year 1875 no less than one hundred and sixty-one persons fell victims to these animals in Russia. Writing of the wolf of the Adirondack region, Dr. Merriam observes that during the deep snows a small pack of wolves will sometimes kill hundreds of deer, taking here and there a bite, but leaving the greater number untouched. In the earlier days of American farming, a couple of these marauders have been known to kill fifteen or sixteen sheep in a single night, simply tearing open their throats without otherwise damaging the carcasses. When the bison existed in countless thousands on the prairies of North America, wolves were in the habit of prowling around the herds for the purpose of preying on sick or wounded individuals and such calves as strayed from the protection of their elders. Frequently, it is stated, wolves might be seen wandering in the midst of a herd of bull bison without attracting the least attention. In general, almost any kind of prey is acceptable to the wolf, which does not by any means disdain a meal of carrion. The larger Mammals, such as cattle, horses, and the bigger kinds of deer, are generally only attacked when several wolves are associated together; but it is stated that in Canada a single wolf will kill the largest male reindeer. Birds always form an acceptable portion of the wolf's diet. When hard pressed by hunger, wolves will eat almost anything they come across, down to mice and frogs, and, it is said, even buds of trees and lichens.

The lair of the wolf is formed either in a rocky cavern, within the hollow of a fallen trunk, beneath the roots of an overthrown tree, or more rarely in holes in the ground; such burrows being sometimes dug by the animal itself. A dense thicket will also not unfrequently serve as a hiding place. In these lairs the cubs are born, the number in a litter generally varying from six to ten. The cubs, which are born in the spring, usually remain with their parents till the end of November or December, but may sometimes continue with them for a much longer period. The ordinary cry of the wolf is a loud and prolonged howl. The amount of noise, writes Dr. Merriam, that a single wolf is capable of producing is simply astonishing; and many amusing episodes of camp lore owe their origin to this fact. More than one lone traveler has hastily taken to a tree, and remained in the inhospitable shelter of its branches for an entire night, believing himself surrounded by a pack of at least

fifty fierce and hungry wolves, when in reality there was but one, and (as its tracks afterward proved) that was on the further side of a lake a couple of miles away. By association with domestic dogs, wolves will soon learn to bark. They will breed freely with the larger kinds of domesticated dogs; and it is stated that some of the Indians in the north of America improve the breed of the sleighing dogs by crossing with the wolf.

The endurance of the wolf's gallop has become proverbial. "When pursued by wolves," writes Mr. Lett, "deer make for the nearest water, in which they have a chance to escape, being able to swim much faster than their enemies. Should the river or lake be narrow, the deer generally swim either up or down, seldom straight across; frequently landing, after a detour, on the same side in which they entered the water. By this means the wolves are puzzled and put off the scent. If there are thick weeds or bush along the shore, the deer frequently sinks his body under water, so that no part will appear above the surface but his head, and by this means is enabled to evade the cunning of his pursuers." The wolf displays remarkable caution in avoiding all kinds of traps set for his destruction; and when he is caught will frequently feign death in the hope of being able to escape.

Fossil remains of the wolf occur in the caverns and superficial deposits of England and the Continent; the earliest horizon from which they have been obtained in this country being the so-called forest-bed of the Eastern Coast, which antedates the glacial period.

THE INDIAN WOLF (*Canis pallipes*)

As already mentioned, there has been much discussion as to whether the Indian wolf is distinct from the common species. According to Mr. Blanford, it is distinguished from the common wolf by its smaller size and slighter build, as well as by its shorter fur, which has little or no woolly under-fur. The length is about three feet, exclusive of the tail; and the general color of the fur is a grayish fulvous, usually with a brownish tinge, and sometimes with more or less black on the back. Occasionally, however, a more or less strongly marked rufous tint may be observed. Mr. Blanford states that all the skins that have come under his notice are browner than is usually the case with the common wolf, and are of an earthy-gray color.

The Indian wolf is confined to India, south of the Himalayas. It is rare in Lower Bengal, and unknown on the Malabar coast; and it appears to be replaced by the common species to the west of the Indus, although a few examples are occasionally seen in the Trans-Indus districts. The young are born in holes or caves among rocks during the months of October, November, and December, the number in a litter varying from three to eight.

Its habits are very similar to those of the common species; but, although somewhat gregarious, these wolves do not associate in large packs, six or eight being the largest number that have been seen together. Moreover, it appears to be a rather silent animal, rarely, if ever, howling like the common wolf, but, according to Jerdon, sometimes barking like a pariah dog. Its food includes such Mammals and birds as it can kill, but sheep, goats, and antelopes appear to be the chief favor-

ites. On occasion, these wolves will attack adult human beings, for which purpose two or more will combine together; and in certain districts a large number of children are annually carried off by them from the villages. In the South Mahratta country, Sir W. Elliot writes that he has seen a small pack "steal round a herd of antelope, and conceal themselves on different sides till an opportunity occurs of seizing one of them unawares, as they approach, whilst grazing, to one or other of their hidden assailants. On one occasion, three wolves were seen to chase a herd of gazelles across a ravine in which two others were lying in wait. They succeeded in seizing a female gazelle, which was taken from them. They have frequently been



THE COYOTE.
(One-ninth natural size.)

seen to course and run down hares and foxes, and it is a common belief of the peasants that in the open plains, where there is no cover or concealment, they scrape a hole in the earth, in which one of the pack lies down and remains hidden, while the others drive the herd of antelopes over him. Their chief prey is, however, sheep."

THE COYOTE (*Canis latrans*)

Whatever doubt there may be as to the right of the Indian wolf to specific distinction, there can be none in the case of the coyote, or prairie-wolf, of North

America. This animal is considerably smaller than the common wolf, from which it is also distinguished by its thicker and longer fur and more bushy tail. On account of this greater length of the fur, the coyote appears to be a thicker-built and shorter-legged animal than it really is. The color varies considerably at different seasons of the year, being of a bright, fulvous brown in summer, and gray or grayish in winter; this ground color at both seasons being overlaid with a shading of black, which tends to form stripes along the back and across the shoulders and loins. The under parts are of a dirty white tint; while the upper portions of the muzzle, and the outsides of the ears and legs, are generally tawny. The coyote ranges from the south of Costa Rica, in Central America, to the lower portions of Hudson's Bay. It is still abundant in Texas and Northern Mexico, but is rare in Guatemala; and it has been suggested that it is but a comparatively recent immigrant into Central America.

The coyote is more generally in the habit of burrowing in the ground than the common wolf; it is also far less savage and destructive, and becomes more docile and gentle in captivity. Like the common wolf, it will, on occasions, hunt in packs; and it is at least as noisy an animal, although the tone of its howl is quite different. As regards food, it appears to be almost omnivorous; and, when an animal diet is unattainable, it will feed upon juniper-berries, or the prickly pear. Rabbits, rats, young birds, etc., form, however, its staple diet; and it does not appear that it ever attacks the larger Mammals, although, when wounded and brought to bay, it will defend itself fiercely. In speed it is far inferior to the wolf, and it can be readily overtaken by a good horse. The cubs are born in May and June; the number in a litter usually being five or six, but occasionally ten.

THE ANTARCTIC WOLF (*Canis antarcticus*)

Seeing that no true wolf is found in continental South America, it is strange to meet with a small species, apparently nearly allied to the coyote, inhabiting the Falkland islands. The antarctic wolf is rather smaller than the larger individuals of the coyote, and has shorter fur and a less bushy tail. The general color is yellowish mingled with black, the individual hairs being yellow at the base, with black tips; the fur of the under parts is whitish. White is also the color of the fur on the lips, chin, and throat, as well as on the inner margins of the ears. The most characteristic coloration is, however, that of the tail, in which the first two-fifths are of the same hue as the body, the next two-fifths black, and the remainder white.

The antarctic wolf was discovered by Pernety during his voyage in the years 1763 and 1764, and was again observed by Commodore Byron of H.M.S. *Dolphin*, who circumnavigated the world in 1767. Darwin, who saw them during the voyage of the *Beagle*, writes that "these wolves are well known from Byron's account of their tameness and curiosity, which the sailors, who ran into the water to avoid them, mistook for fierceness. To this day, their manners remain the same. They have been observed to enter a tent and actually pull some meat from beneath the head of a sleeping seaman. The Guachos also have frequently in the evening killed

them, by holding out a piece of meat in one hand, and in the other a knife ready to stick them. As far as I am aware, there is no other instance in any part of the world of so small a mass of broken land, distant from a continent, possessing so large an aboriginal quadruped peculiar to itself. Their numbers have rapidly decreased; they are already banished from that half of the island which lies to the eastward of the neck of land between St. Salvador bay and Berkeley sound." These wolves do not associate in packs, are largely diurnal, and are usually silent, except during the breeding season. They burrow in the ground, and prey on geese and penguins, but are now nearly exterminated.

THE KABERU (*Canis simensis*)

The kaberu, or Abyssinian wolf, is a little-known species, taking its Latin name from the district of Simen, or Semyen, in Abyssinia, where the first specimen brought to Europe was obtained. Although of about the same size as the coyote, it has no claim to be regarded as a true wolf; and may rather be looked upon as an abnormal kind of jackal, in which the size of the body, and notably that of the jaws, has increased, without any corresponding enlargement of the teeth, which are far smaller than in the true wolves. The kaberu, which inhabits mountainous districts, has an extremely long and narrow snout, larger ears than the true wolves, and a thick, bushy tail like that of a jackal. Its general color is a light, reddish brown with a tinge of yellow; the mouth, chest, under parts, and the front of the lower portions of the legs being whitish. The greater part of the upper surface of the tail is mottled with black, and its end is of that color.

THE JACKAL (*Canis aureus*)

With the common jackal we come to the first of a group of species of smaller size than the true wolves, with which they are to some extent connected by the one last described. Their bushy tails are relatively shorter than in the wolves, being generally equal to about one-third the length of the head and body; and their skulls may be distinguished by the smaller size of the flesh-teeth as compared with the molar teeth behind them. As in the case of the wolves, there is some difference of opinion as to the specific identity of the jackals of different countries. The Asiatic jackal is subject to considerable individual variation in point of size; the length of the head and body varying from two to two and one-half feet. Its general color varies from a pale isabelline to a pale rufous, with a larger or smaller admixture of black on the upper parts. The under parts are paler, and the muzzle, ears, and the outer sides of the limbs more rufous than the rest. The reddish brown hairs of the tail have long black tips, thus forming a distinct black tip to the tail itself. The African variety is of rather larger size, with relatively longer ears; and the sides of the body are grayer, and the outer surfaces of the limbs less rufous. Occasionally rufous, black, and white varieties of the jackal have been met with; the latter being true albinos.

The jackal ranges from the southeastern countries of Europe to India and Ceylon; thence it extends throughout Assam to Northern Pegu and the neighborhood of Mandalay, although it is much less common east of the Bay of Bengal than in India. In Northern Africa it inhabits Egypt and Abyssinia, and the districts to the north of the Sahara. In the Himalayas it ascends to from three to four thousand feet above the sea level. Throughout India it may be found indifferently in hilly or plain country, in forest or open districts, or in large cities.

Although jackals are frequently in the habit of going singly or in pairs, they often associate in packs, which may be of considerable size; these assemblages



THE JACKAL.
(One-sixth natural size.)

being more frequent at night than during the daytime. In India the jackal is considered by Mr. Blanford to be a more decidedly nocturnal animal than the wolf, but its wanderings are by no means confined to the night; and, during the winter, jackals may be seen abroad at all hours of the day. In extremely hot weather they appear to suffer much, and may be found either lying in the water, where they spend most of the day, or sneaking away therefrom, instead of being, as usual, hidden away in their holes. Their food comprises not only carrion and the flesh of such animals as they are able to kill, but also fruit, maize, and sugar cane. In the towns

and villages of India the jackals act as efficient scavengers. Occasionally they take to killing poultry and lambs or kids; and Jerdon states that weakly goats and sheep often become their prey, while wounded antelopes are tracked down and killed. Among vegetable foods, the chief favorite seems to be the so-called ber-fruit; but Professor Ball reports that in certain districts jackals do enormous damage to the sugar plantations, biting ten or a dozen canes for one they eat. Like the civet in Java, jackals in the Wynaad district of Madras feed on the ripe fruit of the coffee plant.

Somewhat curiously, the jackal of Eastern Europe and Asia Minor agrees with the Indian rather than with the African variety; the general color being a pale dirty yellow, more or less tinged with rufous, with a variable amount of black on the back. In the Morea, where these animals are very common, they are asserted to be in the habit of disinterring dead bodies from the graveyards.

The cry of a pack of jackals, when heard for the first time, strikes the ear with a peculiarly blood-curdling chill, and gives the impression that it is uttered by a much larger number of individuals than is really the case. Mr. Blanford describes the cry as consisting of two parts; first, "a long wailing howl, three or four times repeated, each note a little higher than the preceding, and then a succession of usually three quick yelps, also repeated two or three times. The common Anglo-Indian version of 'Dead Hindoo, where, where, where,' gives some idea of the call." In the so-called variegated jackal of the Abyssinian Highlands, which is sometimes regarded as specifically distinct from the ordinary North African form, the second half of the cry is omitted.

In addition to the ordinary cry there is, however, as the same writer remarks, another very peculiar call, "only uttered by the jackal, it is believed, when a tiger or a leopard is in the neighborhood, and certainly uttered upon such occasions. The cry is unmistakable; I have several times heard it; but the jackal that makes it carries us at once into the region of fable and folklore. The same story that has existed on the shores of the Mediterranean for two thousand years at least, that a jackal acts as scout for the lions, or 'lions' provider,' and is repaid by a share of the prey, is commonly believed with regard to the tiger in India; and it is this peculiar jackal, known as Pheal, Phiou, or Phnew, in Northern India, the name being taken from the cry, and as Bhalu, or Kol-bhalu, in Southern and Western India, that is said to invariably precede the tiger, and to make the call just noticed. Several observers have, however, remarked that the jackal which makes the cry follows the tiger and does not precede him; and Blyth has observed that a pariah dog, on sniffing a collection of caged tigers in Calcutta, set up a most extraordinary howl, probably similar to that of the Pheal."

Occasionally the skull of the jackal has a peculiar bony process growing from the upper part of the occiput, which is said to be covered during life by a horny sheath, concealed among the hair, forming the so-called "jackal's horn." The female jackal generally gives birth to her young in a hole in the ground, although they have been found in an old drain; the number of cubs in a litter being usually from three to five. The pariah dogs of India breed freely with the jackal. Fossil remains of the jackal occur in the Siwalik hills of Northern India.

The Black-
Backed
Jackal

The black-backed jackal (*Canis mesomelas*), is a very distinct African species. The adults of both sexes are characterized by their bright coloration, the sides of the body being red, the limbs and the upper part of the tail reddish yellow; while the back of the body and the end of the tail are black. In some cases the line of division between the black of the back and the red of the sides is more distinct than in others, and the size of the black area is also subject to variation, although invariably widest over the shoulders. The individual hairs of the body are ringed with black and white or red

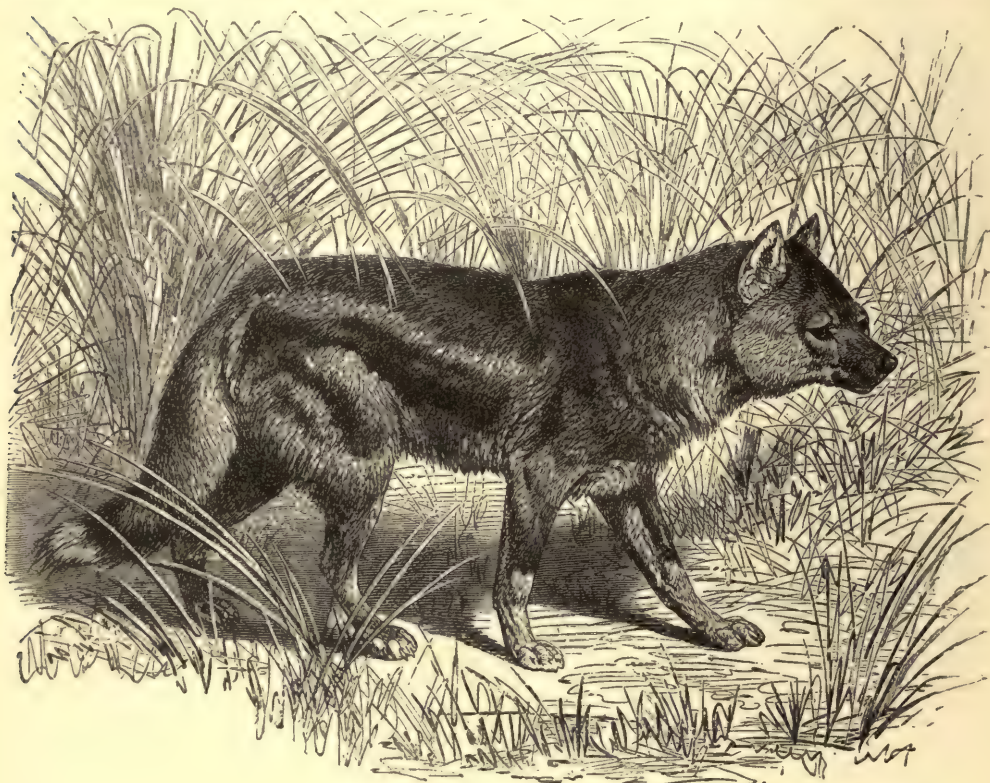


BLACK-BACKED JACKAL.
(One-seventh natural size.)

and white, so as to produce a speckled appearance in the fur. The under parts of the body and the inner sides of the limbs are nearly white, the ears and part of the face being yellowish brown. This striking coloration occurs, however, only in the adult condition, the fur of the young being a uniform dusky brown. The dark band on the neck so often found in the common jackal is absent. The ears are very long.

The black-backed jackal was obtained by Mr. Blanford in Abyssinia, but not at such high elevations as the common species. The northerly limit of this jackal is Middle Nubia, from whence its range extends along the east coast of Africa to the

Cape, although there are many places in this tract of country where it is apparently absent. In South Africa it extends across the continent, and up the western side as far as Mossamedes, but it is unknown in the Congo district. This jackal occurs both in the open country and in bush jungle. In the sandy regions on the shores of the Red Sea it is to be found frequently in the small thickets covering the banks of the ravines, which swarm with hares and pangolins, upon which the jackal feeds. At night it visits the villages of the natives, and in Somaliland it is stated to bite off the fat tails of the sheep. In the Sudan it lives chiefly upon the smaller antelopes, mice, jerboas, and other Rodents. In South Africa the fur of the black-backed



THE SIDE-STRIPED JACKAL.
(One-eighth natural size.)

jackal is much esteemed by the natives, and is used for making their cloaks or carosses.

The second species of South African jackal is the side-striped jackal (*Canis adustus*), so named from the oblique light-colored stripe running along the flanks. The stripe is, however, very variable in its distinctness and degree of development, as may be seen by contrasting our two figures of this animal; and, in consequence of this difference, the species has been described under two specific names—the so-called *C. lateralis* being now proved to be identical with the earlier *C. adustus*, founded upon a specimen in which the stripe

was but little apparent. The side-striped jackal differs from all the other species in the dark-brown color of the hair on the back of the ears; the ears themselves being relatively rather shorter than in the preceding species, although longer than in the common jackal. The snout is characterized by its length and slenderness. The general color of the fur is yellowish brown, becoming paler on the under parts. In examples which exhibit the feature from which the species takes its name, a light-colored line runs on each side of the body from behind the shoulder blade to a point near the root of the tail, a black line bordering the lower margin of this stripe. The greater portion of the tail is black, but its extremity is white.



VARIETY OF THE SIDE-STRIPED JACKAL.
(One-eighth natural size.)

This species has a wide distribution in Central and Southern Africa, having been met with by Du Chaillu in the Gabun district, and by Mr. Johnston in the plains around Kilima-njaro on the East Coast. Du Chaillu states that on the West Coast these animals hunt in packs, surrounding and chasing such kinds of game as they are able to kill. He gives the native name of the animal on the west coast as Mboyoy, but according to Dr. Pechuel-Loesche—who mentions that it is chiefly nocturnal, and seldom seen between the hours of nine and four in the day—it is known in the Loango district as the Mbulu. It preys upon the smaller Mammals

and sick individuals of the larger species, and will also eat the fruit of the oil palm.

In inhabited districts on the West Coast the side-striped jackal frequently enters the native villages, where it interbreeds with the domestic dogs. Its cry, which may be heard night and morning at all seasons of the year, is fully as long drawn and appalling as that of the common jackal. Pechuel-Loesche tells us that these animals can be tamed with facility, and that, when in the Loango district he had several young specimens, one of which attained maturity. They were extremely playful, and would run after and catch almost any animal they saw, including beetles, grasshoppers, birds, and small Mammals. They would readily eat almost anything that was offered them, such as bread, beans, rice, fish, flesh, bananas, and oil palm nuts. Although gentle and friendly as a rule, to some individuals they took a marked dislike, growling and showing their teeth whenever they approached. One of these tame jackals would answer to its name "Mbulu," and was remarkable for the cleanliness of its habits, being particularly averse to getting its feet wet by rain, seeking during showers the shelter of the huts. As a rule it never sat down on its haunches after the manner of a dog, but would lie at full length, with its nose resting between its fore-paws, and would generally select a sunny spot, where it lay blinking in the sunlight.

THE DINGO (*Canis dingo*)

Were it not for the fact that Australia has so few native Mammals which do not belong to the Marsupial group, the dingo would unhesitatingly have been regarded as an aboriginal inhabitant of the country where it is found; in which case it would rank as what we may call a natural species. The improbability of Australia possessing a native placental Mammal of such large size as the dingo is, however, so great as to induce the belief that the animal was introduced by man, and hence that it originated from some of the dogs of Asia. This supposed introduction must, however, have taken place at so early a date that there has been considerable hesitation among some zoologists in admitting any such origin; and certainly the recent arguments in favor of its being an indigenous species have very great weight. Be, however, its origin what it may, there can be no doubt that the dingo is the only true dog now found in a wild state.

The dingo is an animal of smaller size than the wolf, with moderately-tall legs, a long and somewhat bushy tail, a broad and short muzzle, and well-developed ears. In regard to color, Professor Mivart remarks that "the dingo varies in its coloration from red to black. There is a grayish under-fur, but, save in the black variety, the long hairs are generally yellow or whitish. The top of the head and dorsal region generally are of a darker reddish yellow, often intermixed with black. The under parts are paler and may be whitish. The end of the tail is very often white, as are frequently the feet, and sometimes the muzzle, though this is also sometimes black. The animal may be of a uniformly light reddish or yellowish brown, save that it is paler beneath, on the outside of the fore-legs, below the elbow, as well as on the inner side of the limbs and on the cheeks."

The dingo is found in wooded districts throughout Australia, and in many such situations is extremely numerous, although the Government reward for its destruction has in other parts led to a considerable diminution in its numbers. It is a terrible foe to sheep, killing and mangling a far greater number than it eats; and it is equally destructive to poultry. On account of these depredations, the colonists wage a war of extermination against it, large numbers being poisoned with strychnine.



THE DINGO.
(One-eighth natural size.)

Habits

In mode of life and habits Brehm compares the dingo to the fox rather than the wolf. It is shy and retiring, rarely seen during the daytime, and pursuing its work of devastation during the night. It is but seldom found in large numbers together, parties of from five to six individuals—generally consisting of a mother and her cubs—being the most common. Occasionally, however, troops of from eighty to one hundred individuals have been seen. Each family is stated to have a strictly defined area, beyond which its members do not venture, and into which those of other families do not intrude. The young are generally born in the hollow trunk of a tree, and vary from six to eight in a litter. Naturally dingoes never bark, although, like wolves, they easily learn to do so

from association with other dogs. When caught they are generally in the habit of shamming death.

The dingo breeds freely with the various European dogs introduced by the colonists. In regard to their domestication by the Australian natives, Dr. Lumholtz states that on the Herbert river there are rarely more than one or two dingoes in each tribe, and as a rule they are of pure blood. The natives find them as puppies in the hollow trunks of trees, and rear them with greater care than they bestow on their children. The dingo is an important member of the family; it sleeps in the huts, and gets plenty to eat, not only of meat, but also of fruit. "Its master never strikes, but merely threatens it. He caresses it like a child, eats the fleas off it, and then kisses it on the snout. Though the dingo is treated so well it often runs away, especially in the pairing season, and at such times it never returns. Thus it never becomes perfectly domesticated, but still is very useful to the natives, for it has a keen scent, and traces every kind of game; it never barks, and hunts less wildly than our dogs, but very rapidly, frequently capturing the game on the run. Sometimes it refuses to go any further, and its owner has then to carry it on his shoulders, a luxury of which it is very fond. The dingo will follow nobody but its owner."

In writing on the origin of the dingo, Professor M'Coy observes that its fossil remains are found, in certain of the superficial and cavern deposits of Australia, in association with those of a number of extinct species more or less closely allied to the Marsupials still inhabiting the country. The introduction of the dingo—if introduced it really was—is thus carried back to the Pleistocene division of the Tertiary period; but we believe we are right in saying that in some at least of the deposits in which its remains occur there is also evidence of the contemporary presence of man. If, indeed, in all the deposits in which dingo bones occur there were also indications of human presence, the introduction of the animal by human agency would present no difficulty; but it does not appear that such is the case.

DOMESTIC DOGS (*Canis familiaris*)

Although many different views have been and still are entertained as to the mutual relationship and origin of the various breeds of domestic dogs, authorities are agreed that primitively the whole of them were derived either from wolves or jackals, or from both together. Whether, however, the origin has been a single one, that is to say, whether all domestic dogs were derived from one particular species of wolf or from a single species of jackal, or whether they are a product of the crossing of two or more distinct races, independently derived from as many wild stocks, is still an open question, and one indeed which is likely to remain undecided. Our own opinion inclines, however, toward the view of the multiple origin of the domestic dog; but even if its origin be single there can be little doubt that such an original domesticated breed has subsequently received extensive crossing with wild species other than the one from which it originally sprang.

That domestic dogs trace their origin to wolves or jackals, or both together, and not to foxes, is evident from the structure of their skulls; and that the domesti-



AN ESKIMO AND HIS DOGS.

cated races are not descended from the wild dogs of Asia, is evident from the latter having one molar tooth less in the lower jaw than is the case with the other members of the genus. Additional testimony that the foxes have nothing to do with the origin of the domestic dogs is afforded by Mr. Bartlett, who writes that he has never met with a well-authenticated instance of a hybrid between a fox and a dog, notwithstanding numerous specimens of supposed hybrids of this sort, which from time to time have been brought to his notice. Since this was written there has, however, been some evidence published in *Land and Water*, to the effect that these animals may occasionally cross.

The different breeds of domestic dogs present variations far greater, both as regards size and form, than those between any wild members of the canine family. Great as these differences undoubtedly are, they are to some extent paralleled among the various breeds of the domestic pigeons and fowls, the former of which are definitely known to have originated from a single wild stock. But, since dogs of very different breeds freely cross with one another, and the resulting progeny is perfectly fertile, there can be no difficulty in regarding all the domesticated races as now constituting a single species. The fact that at the earliest historical period in which we have evidence of the existence of domesticated dogs, there were several distinct breeds, more or less closely resembling some of those still extant, has been urged as an important argument in favor of the multiple origin of the group; but too much weight must not be attached to this. The main argument in favor of the view of the multiple origin of the dog is that the different early and original breeds of the domestic dogs of different countries approximate in appearance to the wild species of the same regions. For instance, the Eskimo dogs are exceedingly like wolves, and Mr. Bartlett states confidently that we are justified in regarding them as nothing more than reclaimed wolves. Indeed, the Eskimos are said to be in the constant habit of crossing their dogs with wolves, in order to maintain their size and stamina. Then again, some of the more northerly tribes of the Indians of North America have wolf-like dogs, their howls being so like those of wolves that even their owners can scarcely distinguish between the two. On the other hand, the domestic dogs of the Hare Indians closely resemble the coyote, which is the most common species in the districts inhabited by those tribes. These dogs are stated by Sir J. Richardson to present precisely the same relation to the coyote as is borne by the Eskimo dog to the common wolf. Then again, the black wolf-dog of Florida is almost indistinguishable from the black variety of the wolf characterizing that country. Further, many of the sheep-dogs and wolf-dogs of Europe resemble the wolves inhabiting the same districts; and Blyth was struck with the marked resemblance of some of the pariah dogs of India to the wolf of the same country. Moreover in Southeastern Europe and Southern Asia many of the domestic dogs so closely resemble jackals, that it is sometimes difficult to distinguish between them. Still more important is the circumstance that some of the domestic dogs of South Africa present a striking resemblance in form and color to the black-backed jackal of the same regions, although they have lost the distinct black back characteristic of the latter. Equally noteworthy is the resemblance observed between certain South American domestic dogs and the wild Azara's dog of the same regions.

From this evidence Darwin was inclined to believe that domestic dogs were descended from the common wolf and the coyote, from the various local varieties of the former, from the Indian wolf, from Azara's dog and another South American species, from at least two species of jackals, and perhaps from one or more extinct species. "Although it is possible or even probable that domesticated dogs, introduced into any country and bred there for many generations, might acquire some of the characteristics proper to the aboriginal *Canidæ* of the country, we can hardly thus account for introduced dogs having given rise to two breeds in the same country, resembling two of its aboriginal species."

Mr. Bartlett, who is likewise a believer in the multiple origin of domestic dogs, observes that "the fashion of hunting led, in all probability, to the separation of domestic dogs into two well-known breeds, *viz.*, those that hunt by sight, as distinguished from those that hunt by scent; for there can be no doubt that at a very early period dogs were used in the chase of wild animals. . . . The usefulness of dogs being established at a very early period would naturally lead to great care being bestowed upon them, and doubtless to the breeding of them in a domestic state. This would lead to the production of the many breeds and varieties that have been developed, and these varieties may have been perpetuated by the mixing and crossing of breeds originally obtained from distinct wild animals."

With the extraordinary diversity existing among the different breeds of dogs, it is impossible to give any general characteristics by which they can be collectively distinguished from the wild species, with the exception of the habit of barking, which is common to most, although not all, of the former, and is unknown, naturally, in the latter. This characteristic will, however, distinguish other domesticated breeds from the Eskimo dog, and also from the dingo. Very generally domestic dogs have the habit of carrying the tail curled over the back, and thus markedly different from the manner in which the straight "brush" of a wolf or a jackal is borne. Then, again, the acquisition by some domestic breeds of drooping ears is a decided difference from all their wild relatives. And an equally well-marked characteristic of many domestic breeds is the distribution of more or less brilliant colors in patches, in which respect they are widely different from their wild ancestors.

"Domestic dogs," observes Mr. Bartlett, "exhibit many of the habits of wolves and jackals, such as the scratching up of earth with the front-feet, and the pushing back of it with the hind-feet, in order to cover up the droppings. Again, when about to rest, the turning round two or three times with the object of forming a hole in which to repose may be noticed in pet dogs about to lie down upon the hearth-rug, which is a habit evidently acquired by inheritance from their wild ancestors."

That the dog was one of the earliest animals domesticated by man rests upon abundant evidence. Summing up the evidence on this point, Darwin observes that during the Roman classical period hounds, house-dogs, lap-dogs, and other breeds were already well established, although it is in most cases impossible with any certainty to recognize the greater number from their portraits. A fresco representing two greyhound puppies is, however quite distinctive; and it appears that the

ancient Romans were accustomed to class their different breeds into house-dogs, sheep-dogs, and sporting dogs, the latter being again subdivided into fighting dogs, hounds hunting by scent, and hounds hunting by sight (greyhounds). An Assyrian monument with an assigned date of about B.C. 640 shows the figure of a large mastiff; and Egyptian monuments, ranging from about B.C. 3400 to 2100, exhibit numerous figures of dogs, most of which approach the greyhound type. On one monument of the later of these two dates there is a dog resembling a hound, with drooping ears, but with a longer back and more pointed muzzle than those of modern hounds. There is also a short and crooked-legged dog with a long body, which Darwin compares to a turnspit, although thinking it improbable that this ancient race was the parent of the modern breed. The oldest dog represented on the Egyptian monuments is, however, one of the most peculiar, resembling a greyhound in general form, but with long pointed ears, and a short curled tail, a somewhat similar race of dogs still existing in Northern Africa. The ancient Egyptians had also a dog like the Indian pariah. "We thus see," observes Darwin, "that at a period between four and five thousand years ago, various breeds, *viz.*, pariah dogs, greyhounds, common hounds, mastiffs, house-dogs, lap-dogs, and turnspits existed, more or less closely resembling our present breeds. But there is not sufficient evidence that any of these ancient dogs belonged to the same identical subvarieties with our modern dogs." The record of the antiquity of domesticated dogs does not, however, stop with the Egyptian monuments, for there is evidence that several breeds existed during prehistoric periods, that is to say, during the iron, bronze, and polished-stone epochs. Thus, in Denmark, there was one race in the stone epoch, succeeded by a larger one in the bronze age, and by a still larger breed in the newer iron age. Again, during the polished-stone period in Switzerland, the inhabitants of that country had a medium-sized dog which appears to have possessed characteristics common to hounds and setters, or spaniels; its skull being markedly distinct from those of both the wolf and the jackal. In the bronze period this lake-dog was succeeded by a larger kind, probably very similar to the one we have already noticed as occurring in Denmark during the same period. Remains of the lake-dog, together with those of two other breeds, have been recognized from caverns on the Continent; and Wöldrigh comes to the conclusion that the lake-dog was not derived from either the wolf or the jackal but from some extinct species. If, then, we regard the lake-dog as in any way related to our modern breeds, and also admit its descent from an earlier extinct form, it will be apparent how hopeless is the task of attempting to solve the problem of the actual parentage of the dogs of the present day.

The number of varieties of domestic dogs was estimated by Fitzinger in 1876 at no less than one hundred and eighty-five, which were grouped in seven main divisions. Mr. Harting considers, however, that the main groups may be reduced to six, characterized to a certain extent by the form and size of their ears. These groups are — (1) wolf-like dogs, (2) greyhounds, (3) spaniels, (4) hounds, (5) mastiffs, and (6) terriers. By intercrossing between various members of these different groups he considers that all the existing breeds may have been produced. In the case of the more important breeds this grouping will be followed so far as

practicable, although it is frequently difficult to decide under which heading to place many of the breeds produced by crossing members of different groups.

Eskimo Dog The most wolf-like of all the domestic breeds is the Eskimo dog, figured on p. 515. With their small upright ears, nearly straight bushy tails, moderately-sharp muzzles, and rough coats, as well as in their general build, so closely indeed do these dogs resemble wolves that a pack of them has at least on one occasion been actually mistaken for such. These affinities are further indicated by this dog's inability to bark ; and, as already mentioned, it may be considered as merely a domesticated wolf. The Eskimo dog is found throughout the greater part of the Arctic regions, and is absolutely essential to the existence of the inhabitants of those dreary countries, as without its aid they would be unable to make their migrations, or to transport the produce of their sealing and fishing expeditions to their homes. Although differing somewhat in color, the Eskimo dogs of Arctic America, Siberia, and Kamchatka, all resemble one another very closely, and the description of those of one district is equally applicable to those of another.

Many accounts of the habits and appearance of these animals have appeared, but since many of these have been quoted we shall confine ourselves to certain extracts from one of the most recent observers, Dr. Guillemard, who states that on one occasion he had the opportunity of seeing more than two hundred collected together. "Most of them are white, with black heads, or entirely of a brown black ; and their general aspect, owing to the sharp muzzle and prick ears, is decidedly wolf-like. The only food they are provided with by their masters is salmon of the hump-backed kind ; but during the summer they pick up game, eggs, and birds in their wanderings about the country. They are usually inspanned in teams of eight or ten, but where the sledges are heavy or the roads bad, double that number, or even more are occasionally used. When the snow is hard and even, they will draw a weight of 360 pounds a distance of thirty-five or forty miles with ease in a day's work ; and with an unloaded sledge, with a single occupant, a pace of eight versts an hour can be kept up for a considerable time. On the road they are given one-third of a fish twice during the day, and a fish and a half at night, which they wash down with a few gulps of snow. . . . Each has a name, which he answers to when he is driven in the sledge, just in the same way as a Cape ox in a wagon team, for no whips are used. If chastisement be necessary, the driver throws his stick at the delinquent, or pounds the unfortunate creature with any stone that comes handy. There are many ways of tethering these animals, all having in view the one object of keeping them apart, as, excepting upon the road, they seize every opportunity of fighting. One method is by making a large tripod of poles, and tying a dog at the bottom of each ; and in many villages, owing to the large number of dogs which have to be kept, these tripods form a characteristic feature."

In another passage Dr. Guillemard comments upon the hardships to which these animals have to submit. "No comfortable home is provided for him to enable him to withstand the rigors of the Arctic climate, and the poor beast, except when actually at work, has, in most cases, to 'find himself.' Long experience, and the instinct transmitted to him by his ancestors have, however, given him all the resources of an old campaigner. Stumbling at night about the uncertain paths of

the settlements, the traveler is not unfrequently precipitated into the huge rabbit burrows which the animal constructs to avoid the cutting winds. His coat, nearly as thick as that of a bear, is composed of fur rather than hair. . . . Wonderfully well trained, cunning, and enduring, he is at the same time often obstinate and unmanageable to a degree, and is apparently indifferent to the kicks and blows so liberally showered upon him by his master. Excepting in settlements where neighboring stretches of tundra render the use of sledges possible in summer, he has a long holiday during that season. During this time he wanders over the country at will sometimes returning at night to his burrow, at others being absent for days together. A good hunter and fisherman, he supports himself upon the game and salmon he catches, and it is but rarely that he deserts his master for good. But the inhabitants have to pay a good price for his services. Owing to his rapacity it is impossible to keep sheep, goats, or any of the smaller domestic animals, and Kamchatka is one of the few countries in the world in which fowls are unknown."

**Hare Indian
Dog**

As already mentioned, the Hare Indian dog presents the same relationship to the coyote as is borne by the Eskimo dog to the common wolf. This breed is found only in the region of the Great Bear lake and the Mackenzie river, and is used for hunting purposes by the Hare and some other Indian tribes. Richardson states that the "Hare Indian dog has a mild countenance, with at times an expression of demureness. It has a small head, slender muzzle, erect, thickish ears, somewhat oblique eyes, rather slender legs, and a broad, hairy tail, which it usually carries curled over its right hip. It is covered with long hair, particularly about the shoulders; and at the roots of the hair, both on the body and tail, there is thick wool. The hair on the top of the head is long, and on the posterior part of the cheeks it is not only long, but, being directed backward, it gives the animal, when the fur is in prime order, the appearance of having a ruff round the neck. Its face, muzzle, belly, and legs, are of a pure white color, and there is a white central line passing over the crown of the head and the occiput. The anterior surface of the ear is white, the posterior yellowish gray or fawn color. The end of the nose, the eyelashes, the roof of the mouth, and part of the gums are black. There is a dark patch over the eye. On the back and sides there are larger patches of dark blackish gray or lead color, mixed with fawn color and white not definite in form, but running into each other. The tail is bushy, white beneath and at the tip. The feet are covered with hairs, which almost conceal the claws." This dog, although of a playful and affectionate disposition, is not very docile, and is impatient of all kinds of restraint. Its general voice is very like that of the coyote, but when it for the first time sees any new and startling object it attempts a kind of bark.

**Pomeranian
Dog**

Under the title of Pomeranian dog are included a large and a small variety, of which the latter is represented in the figure on the following page. The Pomeranian may be regarded as the nearest ally of the Eskimo dog, and is a middle-sized or small animal, of strong build, with a sharply-pointed muzzle, upright and pointed ears, and a thick, bushy tail generally carried curled over the back. The fur is long and coarse, and varies in color from black through gray, yellowish, and foxy red to pure white; the darker varieties

usually have a lighter patch on the forehead, and also white marks on the feet. The larger Pomeranian was formerly used as a wolf-dog, and should properly be of a pale fawn color, without any admixture of white, and with black "points."

The smaller Pomeranian is a better-known animal, although it has the disadvantage of being somewhat uncertain in temper. The spitz, as this variety is often called, is employed as a sheep-dog in its native country, and is then most esteemed when entirely black. There is, however, on the Continent, an almost complete transition from the pure black to the white spitz, which was the one most commonly



POMERANIAN DOG.
(One-tenth natural size.)

met with in England, till the black breed came into fashion. A well-bred white spitz ought to have a black tip to the nose; and in all cases the ears should be perfectly upright, without any tendency to fall over at the tips. The heavily-furred curly tail is generally carried on the left side of the body. The fur on the throat forms a thick frill or ruff, and there is a considerable amount of long hair on the fore-legs. The face has only very short hair.

Closely resembling the spitz in appearance is the Chinese sheep-dog, the general color of which is reddish, with a mixture of dark brown hairs in the fur of the back, which gives it a somewhat speckled look.

Sheep-Dog The sheep-dog and its ally the Scotch collie depart more from the wolf-like type than the species hitherto noticed, in having the tips of the ears pendent. According to Stonehenge, "the old English sheep-dog has a sharp muzzle, medium-sized head, with small and piercing eyes; a well-shaped body formed after the model of a strong low greyhound, but clothed in long and somewhat thick and woolly hair, which is particularly strong about the neck and bosom." The tail is naturally strong and bushy. In almost all sheep-dogs there is a double dew-claw on each hind-leg, and very often without any bony attachment. The legs and feet are strong and well-formed, and stand road-work well, and the untiring nature of the dog is very remarkable. The color varies greatly, but most are gray, or black, or brown, with more or less white. Many of the sheep-dogs used in Eng-



ROUGH-COATED COLLIES.

land have, however, been crossed with other breeds, and thus depart more or less widely from the original type.

The sheep-dog of France and Germany is very similar in general appearance to the English breed, showing the same indifference to caresses and the same attention to its particular business. Sheep-dogs commence their training during their first year, and learn their work with wonderful rapidity. On the Continent they are employed not only in tending sheep, but likewise goats and cattle; but in England, the variety known as the drover's dog is more generally used for cattle herding.

Collie A handsomer animal than the English sheep-dog is the Scotch collie, which has the same mental characteristics, but differs somewhat in external form and coloration. This dog has the same sharp muzzle as its English cousin,

but a rather broader head, with a slight fall to the tips of the small ears. The build of the body is rather light and elegant; and the hair with which it is clothed is long and woolly, and stands out evenly on all sides so as to form an efficient protection from the extremes of climate to which the animal is exposed in its native hills. The ruff on the neck is more developed than in the sheep-dog, and indeed than in any other breed. The tail is very bushy, and is carried with the tip elevated, so as to keep its long hairs free from the ground. In the pure-bred animal there is a thick under-fur beneath the long hairs, and the hind-legs should be quite free from any fringe of hair, although the fore-legs may have a little fringe. The color may be either black and tan, or either of these tints alone, with a larger or smaller admixture of white; but the black and tan appears to be the most admired. The black is seldom very intense in tone, and the tan has no tinge of the mahogany red of the setter. The collie has been introduced into England as a pet dog, and is often crossed with the black and tan setter, so as to produce a breed which differs considerably from the original form—notably in the silky hair, without under-fur, and the long fringes on both fore and hind-legs. In some parts of the Scottish Highlands, and likewise in the north of England, there is a smaller and more slender variety known as the smooth collie. This breed is characterized by the smooth coat of short and stiff hairs, which are generally of a mottled-gray color, more or less mixed with white, but may be black and tan, or even tan and white.

All the breeds of sheep-dogs display their affinity to the wolf in their elongated and narrow skulls, with very long muzzles, and the profile of the face only displaying a slight degree of concavity. The premolar teeth are separated from one another by distinct intervals; and there is no tendency for the lower incisor teeth to project beyond the line of those of the upper jaw.

Drover's Dog The drover's dog varies considerably in different districts of England, and is generally a cross between the sheep-dog and some other breed. The size of these dogs is likewise very variable; and both this and the general form appear to be modified by breeders according to the special needs of the districts for which the animals are required. Drovers' dogs generally have their tails cut short. Their especial duty is to conduct flocks and herds from one locality to another, and they are remarkably adept in separating the members of the herd under their own charge from those of any other herd which they may meet during their journey.

Pariah Dogs A brief allusion may be made here to those nondescript dogs found in troops in the towns and villages of Eastern Europe, Asia, and Africa, and commonly designated pariah dogs. These animals vary greatly in different districts, but many present a very wolfish appearance, and it is probable that they often interbreed with the wolves and jackals of their respective countries, while in India they may perhaps also cross with wild dogs. Originally, however, these pariah dogs were undoubtedly domesticated breeds, which, from neglect, have reverted to a greater or lesser extent toward a wild state. The pariah dogs of Egypt appear to belong to a single race, and are of about the size of a sheep-dog, but of a stouter build, with a broader head; the tail being long and generally bushy, and carried close to the ground. The general color of their coarse rough hair is

reddish brown, tending in some individuals more decidedly to gray, and in others to yellow. Occasionally black or tawny individuals may be observed. Their ears are short, pointed, and usually erect. They live a perfectly independent life, generally frequenting the rubbish mounds with which the old Egyptian towns and villages are surrounded, and passing the greater part of the day in sleep, while toward evening they wake up and prepare themselves for their nocturnal peregrinations. Each dog possesses its own particular lair, which is chosen with especial care; and frequently one dog will have two such lairs, one of which is occupied in the morning, and the other in the afternoon. When, as is often the case, the mounds in the neighborhood of Cairo run nearly north and south, so that both sides are equally exposed in winter to the cold north wind, the dogs are careful to excavate a hole facing the south, in which they may gain protection from the cutting blasts. In the morning the dogs will be found lying in these lairs, which have an easterly aspect, so that they may receive the full benefit of the sun's rays; toward ten or eleven o'clock, however, these quarters become too hot to be pleasant, and they then shift to the west side of the mound, or to some other shady spot where they may continue their sleep. When the sun reaches their lairs on the western side of the mounds the dogs once more return to their morning haunts, where they remain till sunset.

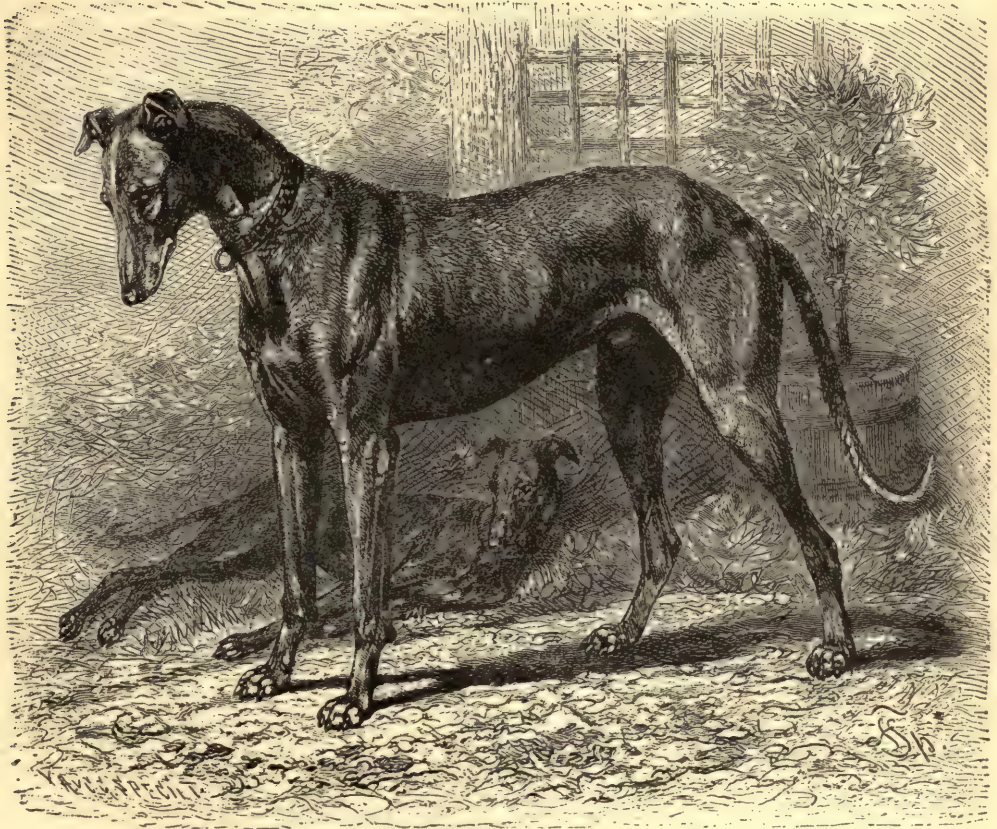
Pariah dogs in other countries are very similar in manners to the above, but in Constantinople and most Indian cities they habitually frequent the streets, and are as habitually ill used by the passers-by. In Siam and some other Buddhist countries they are, however, specially protected by the lamas, or priests, and are allowed to use the temples as places of refuge; but the food supply of these dogs is of the scantiest, and their appearance is consequently miserable in the extreme.

With this breed we come to the first member of the second main group of dogs, all of which are characterized by their long and narrow muzzles, their slight build, elongated limbs, and small ears, falling at the tips; but they differ greatly in the length of the hair. They are further characterized by their habit of hunting either entirely or partially by sight instead of by scent.

The long slender skull of the greyhound points to close affinity with the wolf, and this group of dogs is, therefore, placed here. The English greyhound which is of great antiquity, has indeed been regarded by some as the ancestral stock of all our domestic breeds of dogs, but this is more than doubtful. It may be so readily distinguished at a glance from all other dogs by its general slender form, smooth hair, and rat-like tail, coupled with its comparatively large size, that no detailed description is necessary. The animal is, indeed, thoroughly adapted for extreme speed, the long slender limbs, with their wire-like muscles, giving the utmost possible length of stride, while the smooth coat, sharply-pointed head, elongated neck, and thin tail are calculated to offer the least possible resistance to the air. The long muzzle and neck are, moreover, necessary to enable the greyhound to seize a small animal like a hare when running at speed. We may further notice the great depth of the chest, calculated to afford ample room for the lungs, and the small size of the abdomen. The extremely attenuated muzzle is of itself sufficient indication that the greyhound cannot hunt solely by scent, as it is too small to contain space

for the large extent of surface in the cavity of the nose necessary in dogs that hunt in this manner.

At one period the greyhound became too weak in the jaws to kill its prey, but this defect was remedied by crossing with the bull-dog, the bull-dog blood being gradually eliminated until the proper combination of strength with speed was attained. The head of the present breed should be broad and flat between the ears, without that arching characteristic of other breeds of dogs. The eyes should be of the same color as the coat; and the ears always now fall at the tips, although



ENGLISH GREYHOUND.
(One-tenth natural size.)

there was an old-fashioned breed in which they were erect. The length of the neck should be approximately equal to that of the head; although it is not very easy to say in a living animal where the neck ends and the chest begins. Much importance is attached by breeders to the formation of the fore-quarters of the greyhound, the best strains having the shoulder blades of great length, obliquely placed, and well clothed with muscle, and likewise the upper arm (humerus) of considerable relative length. Of not less importance is the conformation of the

hind-limbs, in which the upper and lower leg should be of great relative length, so that the whole limb should be much bent at the junction of these two segments.

Then again, the hind-limbs must be set rather wide apart at their lower extremities, to allow of their being brought forward with the utmost celerity in running; while in the haunches the attention of the breeder is especially directed to the development of sufficient width. That the foot-pads should be hard and horny, to withstand the wear and tear of racing over hard and rough ground, is self-evident, but there is some difference of opinion as to the precise form of foot which is most desirable. The tail should be entirely devoid of any fringe of long hairs,



ITALIAN GREYHOUNDS.
(One-ninth natural size.)

and, while thick at the root should at first taper somewhat rapidly, and afterward more gradually. It should hang close to the hind-quarters for the greater part of its length, terminating in an upwardly-inclined curve, which generally forms about three-fourths of a circle. Color is regarded as of but minor importance in determining the "points" of a greyhound. A uniform coloration, such as sandy or slaty gray, is, however, generally preferred to a mixture.

This is kept purely as a pet, and may be regarded as a miniature of the English greyhound. Its proportions are most elegant, and its speed considerable; but so delicately is it made that it is incapable of pulling down even a rabbit. The muzzle and tail are relatively somewhat shorter

than in the English greyhound; while the eyes are proportionately larger and softer. There are several colors, among which a golden fawn is the most valued; next to this comes a dove-colored fawn, after which come cream color and the so-called blue fawn. There are also black, red, yellow, white, and parti-colored varieties, several of which depend for their value upon the color of the muzzle. In the uniformly-colored varieties there should not be a single spot of white.

Deerhound The Scotch deerhound, or rough greyhound, is larger and heavier than the English greyhound, frequently standing as high as twenty-eight inches at the shoulder, while its weight may exceed eighty pounds, whereas that of the English greyhound is seldom above sixty-five pounds. The body is clothed with a rough and rather shaggy coat of hair, the texture of which varies in different breeds, being sometimes as stiff as in the wire-haired terriers, while in other cases it is of a more silky and woolly nature. The legs should be devoid of a fringe of hair; while the tail should likewise be comparatively smooth. The favorite colors in the Scotch deerhound are dark, slaty gray, fawn, grizzled, or brindled. White should be absent, although a small spot on the forehead is not objected to. When the fawn-colored variety has the ears tipped with brown it is considered perfect. The Scotch deerhound used to be employed both for deerstalking and for coursing, and this different use has given rise to various strains of the breed.

Irish Wolf-Dogs The ancient wolf-dogs of Ireland formerly enjoyed a reputation for great power and strength and their prowess against wolves. The original breed, or rather breeds, appear, however, to have completely died out, and we are thus acquainted with these animals mainly by tradition and history, although attempts have been made to reproduce them. It appears that there were formerly in Ireland two races of wolf-dogs, one of which was a greyhound and the other a mastiff, somewhat resembling the great Dane; and it is shown from an old figure that there was also a cross breed between the greyhound and the mastiff-like dog, in which, however, the characteristics of the latter predominated. Skulls of these dogs have been discovered in various parts of Ireland, which indicate animals of great size and power. Some of these, belonging to the mastiff-like breed, are considerably larger than the skull of a German boarhound, which stood thirty-two and one-half inches at the shoulder.

Other Greyhounds In Eastern Europe and Western Asia there are several well-marked breeds of long-haired greyhounds or deerhounds differing more or less markedly from one another, of which the Grecian, Persian, and Russian are the best known. The Grecian greyhound, which is used for coursing hares and can run either by scent or by sight, differs from the English greyhound by its completely pendent ears, the moderately long and silky hair clothing the body and the thickly-haired setter-like tail. The Albanian greyhound is a somewhat heavily-built animal, with finer hair on the body and longer and coarser hair on the tail. The Persians have long been celebrated for the excellence of their greyhounds, which, although less fleet than the English breed, are used in relays for coursing gazelles, in which they are aided by falcons. They are likewise employed in hunting the wild ass. The Persian greyhound differs from the Grecian in having the ears fringed with long hair, in its more hairy nose, and also in the greater development of the fringe

of hair on the tail. The hair on the body is, however, intermediate in length between that of the Grecian and English breeds. The color may be either uniform, or a mixture of dark and light. The Russian greyhound is powerfully built, and of rather larger size than his English cousin, being covered with a course woolly coat, and having fringed ears and fore-legs, and a very thickly-haired tail. It is comparatively slow in pace, and hunts the wolves against which it is employed both by sight and scent.



PERSIAN GREYHOUND.
(One-ninth natural size.)

Hairless Dogs Here may be mentioned the hairless dogs of Central Africa, which closely resemble greyhounds in general appearance. These dogs have long slender bodies, moderately elongated and thin necks, narrow and pointed muzzles, tall foreheads, long tails and limbs, and no dewclaws on the hind-feet. Their ears are pendent at the tips; and, like the body, are quite devoid of hair. Indeed, it is only in the neighborhood of the tail, around the mouth, and on the limbs, that there is any hair at all. They are employed in Africa for hunting antelopes, and possess great speed; but their hairless skin renders them unsuited to live in any but the warmest climates. Other breeds of hairless dogs occur in China, Central and South America, Manila, and the Antilles and Bahamas.

Lurchers The lurcher is a cross either between the rough Scotch greyhound and the collie, or between the English greyhound and the sheep-dog, or any pair of these four. Some lurchers are very handsome animals, while others are equally ugly. With these variations it is difficult to give any precise description of the breed, which may, however, be roughly designated as a dog with the general shape of a greyhound, combined with the stouter build, larger ears, and rougher coat of the sheep-dog.

Field-Spaniels With the field-spaniel, of which there are several varieties, we reach the third division of domestic dogs, all of which are characterized by their large pendent ears, comparatively wide heads, with moderate muzzles, relatively short and stout limbs, thick and frequently long hair, and thickly-haired tails. Their skulls are distinguished from those of all the dogs yet mentioned by their width and comparative shortness, this being especially noticeable in the palate and lower jaw. The profile of the skull is also more markedly concave, the brain case rising suddenly at the eyes, and thus indicating great mental power. True spaniels, as their



CLUMBER SPANIEL.

name denotes, are probably of Spanish origin, and are divided into field and water-spaniels, in addition to which there are the smaller breeds kept only as pets. Field-spaniels form some of the best shooting dogs, and generally give notice of the proximity of game by their voice. They are now divided into the Clumber, Sussex, Norfolk, and Cocker breeds.

The Clumber spaniel is distinguished by its silence when hunting; and is a heavily-built animal, of comparatively large size, and soon tiring when at work. The head is massive, with a deep furrow along the top, large flesh or liver-colored nostrils, large and generally hazel eyes, and long ears shaped like a vine leaf, without a very long fringe of hair. In build the Clumber is long and low; the length of the head and body being properly two and one-half times the height. The hair of the body should be silky and of moderate length, with a slight wave, but no curl; its ground color being always white, with yellow or orange spots, the lemon-yellow tint being preferred. The Sussex spaniel, which has the ordinary lobe-shaped ear and

gives tongue when hunting, has a less heavy head than the Clumber, and a wavy coat of a golden-liver color without any admixture of white. The Norfolk spaniel is subject to considerable variation, and is either liver and white, or black and white, in its color. It differs from the two preceding races by the lesser proportionate length of the body, and the longer fringe of hair on the ears, which frequently nearly touch the ground. Cockers are small spaniels, and are now divided into Welsh and modern Cockers; the former being liver, or liver and white, while the latter are larger and generally completely black. The head is relatively long, the eyes are less full than in the other breeds, and the coat is soft, silky, and waved, with a considerable amount of fringe on the throat and limbs.

The King Charles and Blenheim spaniels are much smaller animals, probably derived from the Cocker. The King Charles is black and tan in color, with a larger or smaller admixture of white, and is characterized by the great length of the ears. In both the muzzle is extremely short, with an upturned nose, while the head is nearly globular, and the ears should touch the ground. The coat should be long, silky, and wavy, but devoid of curl; while the ears, limbs, and feet should be abundantly fringed.

Irish Water-Spaniel The water-spaniels, of which the best-marked breed is the Irish, are relatively large dogs, with broad splay feet, and a woolly, thickly-matted, and often curly coat, which is more or less oily. The southern Irish water-spaniel is characterized by the bare face and thinly-haired tail, the presence of a distinct "topknot" on the crown of the head, the long curls round the legs, and the thickly-curling coat of the body and ears; the color being of a uniform puce-liver tint. The northern variety of the Irish water-spaniel has shorter ears, with but little fringe, while the curls of the body hair are shorter and closer; the color being either liver or liver and white.

Setters The various breeds known as setters are large spaniels which have acquired the habit of pointing at their game. They derive their name from having been originally taught to crouch down when marking game, in order to admit of the net with which the quarry was taken being readily drawn over them. With the use of guns this habit became, however, of no advantage, and setters were taught to assume the attitude of pointers. At the present day there are five chief breeds of setters, three of which are commonly seen in England.

The English setter, which is regarded as the result of a cross between the field-spaniel and the pointer, should have a silky coat, with a slight wave, but no curl in the hair. The fore and hind-legs should be thinly fringed with hair, while in the tail the fringe of long hair should fall regularly like the teeth of a comb, without any signs of bushiness. In the middle of the tail the length of the fringe should be from six to seven inches in length, while at the point it should not exceed half an inch. An abundance of hair between the toes is another "point" of the setter. There is great variation in color, which is valued according to the following scale, *viz.*: black and white ticked with large splashes, known as the "blue Belton"; orange and white freckled, known as "orange Belton"; orange or lemon-and-white without ticks; liver and white ticked; black and white with slight tan markings; black and white; liver and white without ticks; pure white; black; liver;

red or yellow. The Irish setter is generally of a red color without any trace of black, and little or no white, but there is one strain characterized by its red and white coloration. It is a rather more "leggy" animal than its English cousin, with a narrower and rather longer head, more produced nose (of which the color is generally deep mahogany), and more tapering ears, which, when extended should reach nearly to the nose.

The Gordon, or black and tan setter, is now characterized by its mixture of jet-black and mahogany-tan colors, although the original breed was black, tan, and



IRISH SETTER.
(One-eighth natural size.)

white. It is a heavier animal than either the English or Irish breeds, this heaviness being specially shown in the head, which makes some approach to that of the bloodhound. The nose is relatively wide, and rarely shows the concave profile of the English setter; the tail is rather short; while the coat, although in some strains silky, may be much coarser than in the other breeds. The Welsh setter, which shows a great amount of variation in color, is distinguished from the preceding by its curly coat. Finally, the Russian setter, according to Stonehenge, "is almost entirely concealed by a long woolly coat, which is matted together in the most extraordinary manner, and which would lead to the supposition that

he would be unable to stand heat as well as our early setters ; but, on the contrary, he bears it almost like a pointer."

Retrievers This name is applied to large dogs employed for retrieving game on land, in contradistinction to the water-spaniels which are used for the same purpose in water. These dogs have more or less Newfoundland blood in them, and trace their other parentage to the water-spaniel or setter. The curly-coated retriever, which may be either black or tan, is the product of a cross between the smaller black Newfoundland and the water-spaniel. It is characterized by the short hair of the face, and the tail devoid of any fringe, although covered to within



NEWFOUNDLAND DOG.
(One-twelfth natural size.)

a few inches of its extremity with short crisp curls. The hair on the body is closely and crisply curled. The wavy-coated retriever may be either a pure-bred small black Newfoundland, or a cross between it and the setter.

Newfoundland The Newfoundland dog, of which there are three distinct breeds, is regarded as nothing more than a large spaniel, and its general form and the facility with which it may be crossed with spaniels and setters seem to fully bear out this view. The especial characteristic of the Newfoundland is its well-known fearlessness of water, and the readiness with which it will risk its own life to rescue human beings from drowning. The true Newfoundland, as repre-

sented in our illustration, is the largest breed, and should stand from twenty-five to thirty or thirty-one inches in height at the shoulder. The coat should be shaggy and somewhat oily, and the tail long and bushy and slightly curled on one side; the color black, with or without some admixture of white; the specimens with the least white being the most admired. Sometimes the black has a rusty tinge. The head in the best-bred animals is large and broad, and nearly flat on the top, with a well-marked ridge at the eyes; while the expression of the countenance conveys a look of grandeur and intelligence without fierceness. The muzzle is relatively wide, and

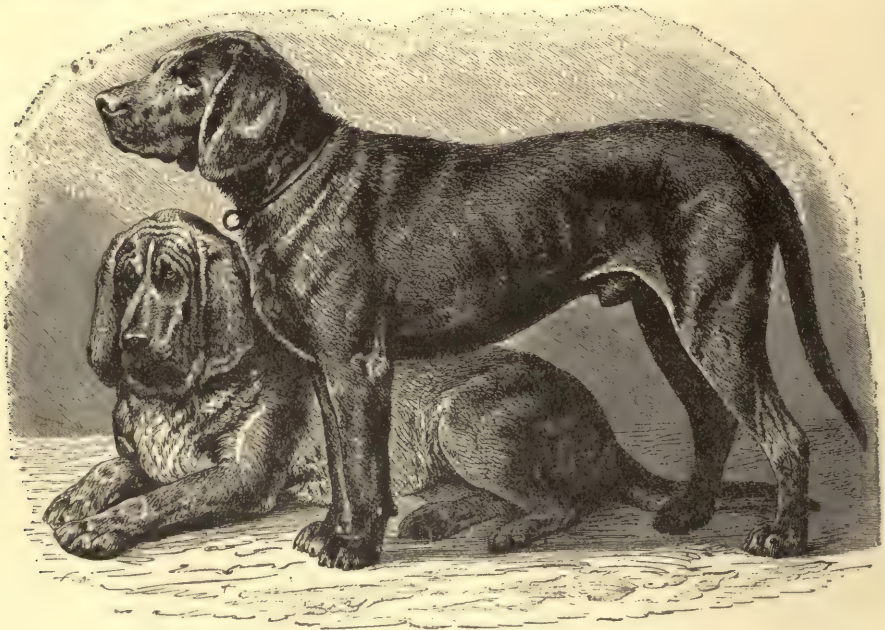


ROUGH ST. BERNARD.
(One-tenth natural size.)

clothed with short hair; while the skin on the forehead should show some slight wrinkles. Both the ears and eyes are relatively small; the former being covered with short hairs, which become slightly longer at the edges, while the latter should be brown in color and mild in expression. The neck has no distinct frill; while the fore-legs should be fringed above, but nearly smooth below. The feet, although necessarily large, should be compact so as not to spread out under the weight of the body. The Landseer Newfoundland, said to be unknown in the island from which these dogs take their name, differs from the preceding in its

looser build, less noble appearance, more woolly coat, and by the ground color being white, upon which are black spots. The smaller black Newfoundland, also known as the St. John's Newfoundland, or Labrador dog, is inferior in size to the Newfoundland, standing not more than twenty-two or twenty-three inches in height, and having a relatively smaller and less massive head. Its coat is moderately short and wavy, without any under-fur, and should be entirely black, although there may be a white spot on the forehead, or a white toe. The fore-legs are fringed with long hair down to the feet.

St. Bernards The magnificent dogs, taking their name from the monastery of Mount St. Bernard, and formerly unknown beyond the Alps and adjacent regions, are remarkable for their high intelligence, and are used in the Alps



BLOODHOUNDS.
(One-tenth natural size.)

for rescuing travelers lost in the snow. In size they attain dimensions only equaled by those of the great Dane, and are larger than any wild member of the family. A very large St. Bernard, known as "Young Plinlimmon," measures upward of sixty-eight and one-half inches from the tip of the nose to the root of the tail; while others are known which measured respectively sixty-four, sixty-three, and sixty inches. These dogs are divided into rough and smooth St. Bernards, according to the length of the hair; our illustration representing a specimen of the rough-haired breed. The rough St. Bernard has the coat of the body long and wavy, with the tail very bushy, and the fringe on the fore-legs comparatively small. There is great variety in color; one strain being a rich orange tawny mixed with brown, others are red and white, others, again, brindled or fawn, or those colors

more or less mixed with white, while some may be almost white. The head is large, with a higher elevation at the eyes than in the Newfoundland, and the muzzle rather long and squared, with slightly pendulous lips. The ears are relatively small, and their hair should be rather rougher than that of the body. The eyes are full but deeply set. The feet are very large, apparently for the purpose of supporting the animal in the snows of its native home, and may be furnished with double dew-claws. The smooth St. Bernard differs mainly from the rough breed by its nearly



STAGHOUNDS AFTER A CHASE.
(One-tenth natural size.)

smooth coat; the tail being comparatively thin, and the legs and ears entirely free from any fringes of hair.

Bloodhound The bloodhound is our first representative of the fourth division of domestic dogs, which includes the pointer, and all those usually denominated hounds. All are characterized by their large drooping ears; and most of them by their smooth coats, and the absence of any fringe of hair on the ears and legs; while the tail is mostly but thinly fringed. The profile of the face is but slightly concave, and the muzzle relatively long and deep, with a more or less marked overlapping of the upper lip. With the exception of the pointer, they hunt by "foot-scent."

The most striking and characteristic feature of the bloodhound is its magnificent head, which is considerably larger and heavier in the male than in the female. While generally extremely massive, the head is remarkable for its narrowness between the ears, where it rises into a dome-like prominence, terminating in a marked protuberance in the occipital region. The skin of the forehead, like that round the eyes, is thrown into a series of transverse puckers, as is well shown in the recumbent figure of our illustration. The long and tapering jaws are of great depth but relatively narrow, and abruptly truncated in front; while the upper lips are pendulous. The large and thin ears should hang close to the cheeks; and the small and deeply-sunk hazel eyes are characterized by the exposure of a considerable part of the membrane of the socket, which is generally red, and is technically known as the *haw*. The throat is heavy, and passes downward into a more or less well-marked dewlap. In the English breed the tail is slightly fringed with hair, although in our figured example it is quite smooth; it should be carried in a curve, but not raised above a right angle with the line of the back. The short coat should be coarse and hard on the back and sides, but soft and silky on the head and ears. The most esteemed coloration is black and tan, but the animal may be all tan; the presence of white being a blemish. Our illustration is taken from a foreign strain of the bloodhound, which is lower on its legs than the English breed.

Staghound English hounds are descended from two extinct breeds, respectively known as the southern hound and the northern hound. Both of these were large heavily-built animals, with thick throats, distinct dewlaps, and large pendent ears resembling those of the bloodhound. They were slow in pace, and dwelt upon the scent more than their modern descendants. The true English staghound was a considerably larger animal than the foxhound, with a relatively broader and shorter head, and a more thickly-fringed tail, and was also distinguished by several points in the conformation of the limbs. The large foxhounds now used for stag hunting in England stand about twenty-five inches high in the males, and from twenty-three to twenty-three and one-half inches in the females.

Foxhound The modern foxhound, derived from either the old southern or northern hound, with perhaps some cross of a different breed, is remarkable for the combination of speed and endurance which it possesses, and is thus an excellent instance of the results which can be attained by breeding with a particular end in view. The appearance of the foxhound is much modified by the artificial rounding of the ears—a process in which a large portion of the extremity of the lobe is cut away in order to prevent its becoming entangled in bushes. The coat should be short and hard, but at the same time glossy; the tail having a distinct fringe of hair on its under surface. The favorite, or true hound color, is black, white, and tan; but there are also several “pies” in which the respective colors are blended with white; while whole colors, or black and tan only, are not unknown. The endurance and speed of the modern foxhound is fully attested in numerous works on sport, and will not, therefore, be further mentioned here. Stonehenge observes that a peculiar “faculty in which the hound differs from his congeners is a mental one, leading him always, when he loses scent of his quarry, to cast forward rather than backward, and to do this with a ‘dash’ altogether un-

like the slow and careful quest of the bloodhound. This, of course, may be overdone, and in that case the hound constantly overruns the scent ; but without it in these days few foxes would be killed, for unless they are hard pressed the scent soon fails and is altogether lost." For ordinary country the male foxhound, should average twenty-four inches, and the female twenty-two and one-half inches in height ; but in hilly districts smaller hounds are preferred.



FOXHOUNDS IN FULL CRY.
(One-ninth natural size.)

Harrier

This is a breed of hound trained to hunt hares instead of foxes, and intermediate in point of size between the foxhound and beagle. Pure-bred harriers, probably descended from the old southern hound, are to be met with in Wales, but many of those used in England are crossed with the foxhound, while in some cases a small breed of foxhounds is employed in hare hunting. Owing to the absence of the practice of "cropping," harriers may be distinguished from foxhounds by their larger and pointed ears ; and they generally have longer and narrower heads, with a deeper hollow under the somewhat fuller eye. The height generally varies from sixteen to a little below twenty inches. The colors and general

points are the same as those of foxhounds. A rough breed of Welsh harriers is practically indistinguishable from the otterhound. Harriers work more slowly than foxhounds, dwelling more on the scent and tending to cast backward rather than forward when they come to a check.

Otterhound This breed so closely resembles a large rough Welsh harrier that it requires an expert to distinguish between the two; such difference as there is existing in the nature of the coat and the form of the feet. Thus the feet

instead of having the neat cat-like form of those of the harriers, are broad and splay; while the coat is furnished with a thick, woolly under-fur of an oily nature. Probably owing to having to contend with such a fierce animal as the otter, the otterhound is of a savage and quarrelsome disposition, and is very



THE OTTERHOUND.

apt to engage in internecine conflicts with its fellow-occupants of the kennel. Otter hunting is a favorite sport in the west of England, Devonshire alone possessing four packs, one of which in the summer of 1892 killed three otters in a single morning. In some cases foxhounds are employed for otter hunting.

Beagle This term is generally applied to any hound standing less than sixteen inches in height, although the true pure-bred beagle is a distinct breed, which may be regarded as a miniature of the old southern hound. In build the ordinary beagle is rather short in the limbs and long in the body, with a relatively wide and somewhat dome-shaped head and a short nose. The throat is likewise rather short and thick, and the older breeds used to have a tendency to a dewlap. The ears are full and hang in folds. Beagles may vary in height from about fifteen to ten or nine inches; but from eleven to twelve inches is esteemed the best. They are used in hunting both hares and rabbits. The beagle has a remarkably musical note and an exquisite sense of scent, as well as great perseverance in following a trail. From its small size, short legs, and rather heavy build, it is, however, necessarily slow. In hunting, beagles follow all the windings of the hare, and for the first part of the chase are far behind their quarry. Their perseverance is, how-

ever, generally successful in the end ; and there is no prettier sight for the lovers of sport than to watch a well-trained pack of beagles at work.

Turnspit With the cessation of its monotonous occupation has been brought to pass the practical extinction of the old English turnspit. These dogs were long-bodied, short-limbed animals, with the fore-feet everted, and were closely allied to the dachshund ; but differed in being relatively taller, with a longer head, longer nose, straighter forehead, less bent fore-limbs, and a longer and thinner tail ; the ears being small and placed relatively far back. In color, the turnspit was generally black and tan. These dogs performed their task in a kind of wire barrel, somewhat like that in a squirrel cage ; and in England two of them were generally kept, which worked turn and turn.



THE BEAGLE.
(One-third natural size.)

Dachshund Under the title of dachshund, or badger-dog, the Germans include two distinct strains of long-bodied dogs with short and crooked legs, one of which presents these characteristics in a less marked degree than the other, and has also relatively larger ears. The breed figured in our illustration has a long cylinder-like body, supported on short and bent legs, the head and muzzle large, the drooping ears also large, the paws of great size and furnished with sharp claws, and the coat short and smooth. The fore-feet are markedly turned outward, and the hind-feet have large dewclaws ; while the tail is thick at the root, from which it rapidly tapers to the end, without any fringe. The color varies, but is generally black and tan, although not unfrequently either tan or yellowish, and sometimes gray or parti-colored. The second variety has a still longer body, and shorter and

more bent legs than the preceding form, from which it is likewise distinguished by its smaller ears and shorter tail. The ear is set further back than in any other dog, its front border being scarcely in advance of the line of junction of the head with the neck. The tail should be carried over the back, and the smooth and glossy coat hard and wiry, except on the ears, where it becomes silky. Black and tan are the favorite colors in this breed ; but whole tan, with a black nose, occupies the second place in the estimation of fanciers.

Dachshunds are used in their native country chiefly for hunting badgers, which are numerous in some districts. The strain with the longest body and the shortest legs is employed for digging the badgers out of their holes, while the other is used in the chase. From their small size and short limbs dachshunds are, of course, ex-



THE DACHSHUND.
(One-eighth natural size.)

tremely slow, but they have a keen scent, coupled with great perseverance and endurance, and therefore make admirable hounds. From its somewhat squeaky voice the dachshund has been regarded as more nearly related to the terriers than the hounds, but there is no doubt that its place is among the latter. In addition to badger hunting, dachshunds are also employed in Germany in fox hunting, as well as in driving game, more especially roedeer, which require to be driven with great care and quietness in order to prevent them breaking back through the line of beaters.

Pointer That the various breeds of pointers are descended from the hound was first clearly indicated by Youatt. The disposition to "point" appears to be due to the results of training ; and although other dogs have been taught to point, in no case do they assume the rigid condition so especially characteristic of the pointer. Indeed, in some of the old Spanish and French pointers, so intensely was this characteristic developed that the animals assumed a kind of cataleptic condition ; and Stonehenge mentions that he has known some of them remain on

the "point" for hours, until absolutely exhausted. Moreover, such dogs would frequently make "points" at imaginary game.

The pointer differs from the hounds in hunting by "body scent" instead of by "foot scent." The most ancient breed appears to have been the old Spanish pointer, which stood relatively high on the legs, and had a heavy, clumsy head, with a long, wide, and squared nose, pendulous upper lip, with ears nearly as large as those of the bloodhound, and a massive throat and distinct dewlap. This pointer was of a surly disposition, slow in pace and apt to give chase to hares. His redeeming point was, however, his marvelous perception of scent, and the perseverance with which he would work his game. The Portuguese pointer is of rather shorter build, with badly-formed legs and feet, and a long and fully-fringed tail, and displays the same faults of character as the Spanish breed. The French pointer is distinguished by the presence of a furrow between the nostrils, which renders its sense of smell less acute. It is, however, a better-shaped and more-active dog than either of the two preceding breeds, with more power for hard work, but quarrelsome and given to hare chasing. The modern English pointer is the lightest and best-shaped dog of the whole group, and is believed to have been derived from the Spanish breed, with some intercrossing either directly with the greyhound or indirectly through the foxhound.



ENGLISH POINTER.

This breed is characterized by its compact and well-knit build, sloping shoulders, straight muscular limbs, and spirited action. The head is still relatively large, but the pendulous upper lips, dewlap, and the heaviness of the throat have been lost. The nose should be long, broad, and square in front. The eyes are moderately large, soft, and intelligent, the color varying from buff to dark brown. A peculiarly rounded outline on the upper side of the neck marks the well-bred pointer, which can hardly be described in words. The tail is as straight as possible, with no trace of a fringe, sharply pointed at the end, and carried low. The coat is soft, although not silky. With regard to color, there are two strains, distinguished as the "lemon and white," and the "liver and white," which are the most numerous and the most esteemed; in addition to which there are entirely black and entirely liver-colored pointers, the latter being very rare. There are also black and

white, and black, white, and tan varieties ; a dog with much white being preferred, in order that he may readily be seen among turnips. There has been much rivalry as to the merits of the lemon and white, and liver and white pointers ; the one strain being in the ascendant at one time and the other at another. In the best-bred pointers the head should be carried high when at work ; animals which have too much of the foxhound in their blood carrying the head down, and seeking after a "foot scent," instead of trusting entirely to the "body scent," while their tails are not carried in the orthodox rigid position.

Dalmatian Dog

The Dalmatian, coach, spotted, or "plum-pudding dog," is probably allied to the pointer and hounds, although there have been suggestions of its affinity to the great Dane. It is distinguished by its dark spots which are by preference jet black on a white ground. In the modern breed these spots are large and evenly distributed, but in the older breed they are much smaller, and more like the "ticks" or flecks of the pointer. As being in England essentially a carriage-dog, next to the regularity of its spots attention is directed to the perfect development of the limbs. In its native country the Dalmatian dog is employed as a pointer, and is said to stand well to game.

Mastiff

With the mastiff we arrive at the fifth division of domestic dogs, characterized by the more or less shortened muzzle, in which the lower jaw frequently projects beyond the upper, while the skull is greatly elevated above the eyes by the enlargement of the air cells in the frontal bones. The typical forms are of large size and powerful build, with either pendent or erect ears, pendulous lips, and generally short coats and thin tails. They are used chiefly as watch-dogs, or for fighting. Of the true mastiffs there are two breeds, the English and the Cuban. The modern English mastiff is a powerful dog of large size, which, when pure bred, is distinguished by its fully pendent ears. The head is relatively larger, and the body less massive than in the bull-dog ; the head showing a slight furrow down the middle, and the body having a slight bend. In height the male should not fall below twenty-nine inches, while the female should reach at least twenty-seven inches. The coat is fine and soft, but may become rather rough on the tail. The color most esteemed is either a stone fawn with black "points," or a brindle, without any admixture of white ; but red mastiffs are not unknown.

Bull-Dog

This dog is distinguished by its hideous appearance, its ferocity, and its low degree of intelligence. Its head should be square in shape, and as wide as possible, while the skin on the forehead should be well wrinkled. The indentation between the eyes, technically known as the "stop," should be of great depth and size ; while the eyes should be dark, rather prominent, far apart, and set horizontally. The ears, which vary somewhat in shape, are required to be small, and placed high on the head, although not at its summit. Breeders also attach importance to the shortness of the upper as compared with the lower jaw, this being an essential feature when the dog has to seize large animals. Needless to say, the tusks should be large and powerful, and the incisor teeth ought to form a regular series. The shape of the body and limbs is admirably adapted for the attain-

ment of the maximum strength and power. A male should not exceed fifty pounds in weight, while the female should scale about ten pounds less. The coat should be close and fine, the favorite colors being either pure white, or white marked with brindle, fallow, or red; while uniformly-colored brindle, fallow, or red dogs come next in estimation. Entirely black or black and white bull-dogs are less valued.

Bull Terrier This breed, as its name implies, is a cross between the bull-dog and the smooth terrier; but it varies in form and size according to the amount of bull or terrier blood. The jaws must be long and powerful, and the



THE BULL-DOG.
(One-eighth natural size.)

hollow between the eyes of the bull-dog should be quite eliminated, while the profile should be nearly straight. The coat should be short, firm, and close, and, in a perfect animal, should be milky white throughout, the nose being black. The worst point about a bull terrier is its quarrelsome disposition, which is rendered all the more objectionable by its courage and strength.

Boarhound The German boarhound, together with the variety known as the great Dane, is the largest European representative of the mastiff group. These dogs have long been bred in Germany and Denmark, although but comparatively recently introduced into England. In their native countries they

were originally used for boar or deer hunting, but are now more often employed as watch-dogs. There is considerable variation in these dogs, and it is difficult to determine which is the true breed. Stonehenge regards the boarhound and the great Dane as in all respects identical, but Brehm considers them distinct, and is of opinion that while the German boarhound is a pure-bred animal, the great Dane is a cross between the bull-dog and the greyhound. The great Dane, according to



GERMAN BOARHOUND.
(One-twelfth natural size.)

Brehm's description, is a magnificently-proportioned animal, with slender limbs, rather pointed muzzle, slender tail, and large full eyes. It is generally either yellow and black, or yellow in color, and even in its native country it is a comparatively rare breed. The ears are always cropped, and thus lose their pendent tips. It was formerly used in deer hunting. The boarhound is a shorter-haired and thicker-muzzled dog, with a proportionately shorter and thinner tail. The color

is generally black, light or dark gray, brown or yellow, the light shades being often brindled. There are often white spots on the chest, and one or more white toes in the lighter-colored examples. An unusually large dog measured upward of thirty-five and one-half inches in height at the shoulder, when in his third year. In the Black Forest these dogs are still used in boar hunting.



PET PUGS.
(One-sixth natural size.)

Pugs

The curly-tailed pug-dog, which is a diminutive member of the mastiff group, is kept solely as a pet, and has suffered considerably from the caprice of fashion in England, where it was much esteemed in the last century, until it was suffered to fall into the neglect from which it was recently resuscitated. The color is either yellow or stone fawn, with black "points"; these black points comprising the face and ears, an area under the tail, and a more or less well-marked streak down the back, which, in the so-called Willoughby pug, is most esteemed when it spreads out into a saddle-shaped patch. The coat should be soft, short, and glossy, except on the tail, where it should be rougher; the tail itself being

tightly curled, so as to lie on one side of the back, with rather more than one complete turn. The head is rounded, and second only in relative size to that of the bull-dog, with a short but not retreating face. The black ears should be short, and shaped like a vine leaf; the teeth even; and the dark brown eyes full and soft. The body is thick and "punchy," with a very loose skin; and the legs should be straight, with small bones, narrow feet, and dark nails, without any white on the toes. A black mole on each cheek, with several long hairs growing from it, is also considered an essential point in a pug.



TIBET DOG.
(One-twelfth natural size.)

The Chinese, or, as it is often incorrectly called from being imported into Japan and thence taken to Europe, the Japanese pug, is a still more extraordinary animal, exhibiting a kind of degradation from overbreeding. One of these taken to England about 1867 was a slender-legged animal with very long hair, and the bushy tail closely curled over its back. The face was extremely short, and the jaws very feeble, with only a single pair of incisor teeth in the lower one. This pug lived chiefly on vegetables, and exhibited a special partiality for cucumbers.

Tibet Dog This dog is a magnificent animal, usually placed among the mastiffs, with which it agrees in the general physiognomy, and especially the large pendulous upper lips, or "flews," as they are technically termed. It

differs, however, from all other members of the group by its coat of long shaggy hair, with a thick under-fur, and the large bushy tail, carried curled over the back. The development of this thick pelage is, however, probably an adaptive characteristic due to the nature of the winter climate of the regions of which it is a native. The expression of the countenance is stern and fierce, from the deeply-sunken eyes, overhanging eyebrows, and the deep folds into which the skin of the forehead and cheeks is thrown. The ears are pendent, and the greatest development of hair is on the throat and chest. In color these dogs may be either entirely black, black and tan, or tan; and in size they are fully equal to the largest European dogs.

The Tibet dog is used as a watch-dog in the villages and encampments in the Highlands of Tibet and the neighboring regions, extending westward into Ladakh, and southward into Sikkim. It is invaluable in protecting the flocks from the inroads of wolves and wild dogs. On reaching a Tibetan village or encampment in the higher regions of Ladakh, the traveler is assailed by the baying of at least half a dozen of these dogs, and until they are leisurely called off by the women the sensations of the visitor, as the writer knows by experience, are sometimes the reverse of pleasant. In the more eastern portions of its range the Tibet dog, in common with sheep and goats, is pressed into service as a beast of burden.

Fox Terrier With the fox terrier we reach the last group of dogs, which includes the terriers, the poodle, and a few other species. All terriers have moderately-short and highly-arched skulls, in which the elevation is mainly due to the large size of the brain case, and consequently indicates a high degree of intelligence, the jaws being generally rather short.

The smooth fox terrier was formerly used for unearthing foxes, two of these animals being attached to every pack of hounds; but is now one of the most favored breeds of companionable dogs. It should have a hard, thick, and glossy coat, of a pure white ground color, more or less fully marked with black and tan, black, or lemon color, liver-colored markings being objected to. The "true hound color," that is white and black and tan, is the most esteemed; and it is considered that this type of coloration has been produced by a cross with either the black and tan terrier or the beagle. There has been much discussion as to the advisability of a strain of bull-dog blood in the smooth fox terrier; such strain showing itself by a tendency for the lower jaw to be "underhung," and also an unusual massiveness of the jaw muscles. The weight may vary from fifteen or sixteen to twenty pounds. In a pure-bred animal the head should be flat and rather narrow, tapering from the ears to the muzzle, with a slight hollow in front of the eyes, but none between them. The jaws should be long and tapering, with a moderate prominence of the masseter muscle, and the nose must be black. The eyes are small, without prominence, and the ears likewise small, in shape resembling the letter V, and set close to the cheeks, with their points directed forward and downward.

The rough fox terrier came into popular favor at a later date than the smooth breed, although it had been bred for many years in the west of England. Stonehenge, observes that it "may be regarded in all respects as similar to his smooth brother, with the exception of his coat, which on the body and legs should be about twice the length of that on the smooth dog, with the addition of a thick under-

pile of a woolly nature, and furnished, like that of the otterhound, with a certain amount of oil, so as to resist the action of the water."

Irish Terrier The rough Irish terrier, which seems of late years to have replaced the old Scotch terrier, is a rather large dog, varying in weight from seventeen to twenty-five pounds, with a hard, rough, and wiry coat, having no tendency to curl. The most-admired color is bright reddish bay, usually termed "red," but it may vary through different shades of brown and yellow to gray. The tail is generally cut, but if kept entire should curve. Great importance is attached to the form



WELSH TERRIERS.
(One-sixth natural size.)

of the head, which should be long and rather narrow, without any wrinkles or hollow between the eyes. When uncut, the ears should be small, filbert shaped, and lying close to the head without any fringe of hair, and rather darker in color than the head. The small eyes should be hazel, and the nose black. The rough terriers, figured in the illustration, belong to a breed known as the Welsh terrier.

Skye Terrier Very different to either of the above is the long-bodied, short-legged, and long-haired Skye terrier, of which there are two distinct breeds, distinguished by the form of their ears and the proportionate length of the body.

The first of these is the drop-eared or smooth Skye, in which the ears are pendent, and the body almost or quite as long proportionately as in the dachshund; the length of the animal, from the tip of the nose to the end of the tail, being in perfect specimens as much as three and one-half times the height. The coat should nearly touch the ground, and almost conceal the shape of the body; the long hair being straight, coarse, and shiny, and naturally parting down the middle of the back, while beneath this there is a thick, woolly under-fur. The most approved colors are "blue," black, or grizzle, next to which comes silver grey with the hairs tipped with brown, and then fawn with the tips of the hairs also brown. The long hair makes the head appear larger than it really is. It should be rather narrow, and nearly flat at the top, with little or no elevation at the eyes. The nose and the roof of the mouth

must be black or dark brown, and the ears should be about three inches in length. The latter should have very long hair, which, together with the long hair of the eyebrows and cheeks, should fall over the eyes. The height of the Skye terrier varies from nine to ten inches; the length in the former case varying from about thirty to thirty-three inches. The prick-eared Skye is a shorter-



YORKSHIRE TERRIER.

bodied dog, with a larger and squarer head, a rougher coat, and large, pointed, erect ears terminating in a distinct tuft.

Dandie
Dinmont

Much alteration has ensued in the appearance of the Skye terrier, through the fancy of breeders, but the modification is not near so great as that which has taken place in the Dandie Dinmont, whose height now varies from eight to eleven inches at the shoulder, and weight from fourteen to twenty-four pounds. The hair on the top of the head is soft and silky, while that on the jaws is harder and darker. The upper surface of the tail has wiry hair of a darker tint than that of the body, while below it is softer and lighter in color. The ears terminate in a distinct point of hair. The prevailing color is either "blue" or "mustard," but in the former case the hair on the fore-legs and feet should vary from tan to fawn, while in the latter they should be darker than the creamy-white head. The ears vary from brown to black, and the eyes are hazel.

**Yorkshire
Terrier**

The last of the long-haired terriers that we shall mention is the Yorkshire or Halifax terrier. This is a small breed, readily distinguished by the enormous length of the long and silky hair, especially on the face. On the body the length of the hair is about three or four inches, while on the face it reaches as much as six or seven, and thus communicates a most grotesque appearance. The color on the upper parts is a grizzled "blue," owing to the mixture of dark with light hairs, while tan occupies the same parts as in the black and tan terrier.

English Terrier Under the title of English terriers may be included the short-haired dogs commonly known as the black and tan terrier, with its diminutive representatives, the toy terrier and the white terrier. The black and tan, or Manchester terrier, is too well known to require any description. It is of about the same average size as the fox-terrier, varying in weight from some ten or twelve to as much as eighteen pounds. Especial attention is paid to the coloration of this terrier, the black being required to be of jetty fullness, and sharply defined from the



SMOOTH AND ROUGH TERRIERS.

tan, which should be of a rich mahogany. The tan should occupy a spot over each eye, and another on the cheek, as well as the sides of the jaws backward to the lower parts of the cheeks, ending on the throat. It should also occupy all the under parts, the inner sides of the ears, a spot on each side of the chest, the whole of the inner sides of

the limbs, their outer sides as far as the wrist and ankle joints, and the whole of the feet, with the exception of a narrow line of black along each toe. The black and tan toy terrier is merely a diminutive derivative from the Manchester terrier. It should not exceed six pounds in weight, and is most prized when it only weighs three and one-half or four pounds, if it at the same time exhibits perfect symmetry. The white English terrier is a less well-known breed, having the same general characteristics as the Manchester terrier, but of a pure opaque white color, with dark eyes, nose, and claws.

Poodle

Although very different in appearance to the typical representatives of that group, the poodle, which is perhaps the cleverest of all dogs, and the one most apt to learn tricks, is included among the terriers. The general

appearance is so well known, and is likewise so truthfully portrayed in our illustration, that it will be unnecessary to refer to it. There are several strains, differing mainly from one another in size; the usual colors being either black or white, or a mixture of the two. The coat should resemble astrakan, but may incline more to a silky or to a woolly nature in the different strains. When clipped it should present a satiny sheen. Both on the Continent and in England the poodle is clipped to a greater or less degree; but whereas abroad the coat is permitted to grow in winter, in England the clipping is too often continued at all seasons. In England and Russia the poodle is treated solely as a companion and house-dog; but in France and



WHITE AND BLACK POODLES.
(One-tenth natural size.)

Germany it is employed as a sporting-dog, and is the constant outdoor companion of the farmer. It is an excellent water-dog, diving well, and seldom failing to find a wounded bird in the water; the oily nature of its coat being an admirable protection against chills. In retrieving on land the poodle relies fully as much on its general intelligence as on its sense of smell, thereby resembling the Newfoundland; and it generally hunts by casting round in circles, rather than by following a direct trail. Poodles are generally the dogs employed in circuses as performers, and they have frequently been taught to recognize and pick out many of the cards from a pack at the direction of their masters. As a remarkable instance of intelligence, Dr. Romanes

relates a case where a poodle, having on one occasion conducted his master to the larder, and been rewarded with a piece of meat, essayed to lead him again to the same spot. Being baffled in this attempt, the dog thereupon took up his master's hat, with which he proceeded to the larder, and lay down beneath the shelf on which was placed the coveted joint.

This dog may be compared to a diminutive Skye terrier, and should
Maltese Dog not exceed some five or six pounds in weight. It has a short body and is covered with very long and silky hair, which is of a uniform semitransparent white color, the tail being thickly haired and carried tightly curled over the back. The nose and roof of the mouth are black, and the hair of the moderately long ears, as in other terriers, mingles with that of the neck.

The Mexican lap-dog is also pure white in color, but with a flesh-
Mexican Lap-Dog colored nose. The hair on the head and body is moderately long and curly, but that of the rather short tail longer and straighter. The ears are small and not pendent, and the head rounded, with the brown eyes widely separated from one another. An apparently adult specimen of this diminutive breed preserved in the British Museum measures only 7.1 inches from the tip of the nose to the root of the tail.

ASIATIC WILD DOGS (*Canis alpinus*, *deccanensis*, etc.)

With the Siberian wild dog (*C. alpinus*) we revert to the consideration of the wild members of the *Canidæ*. It belongs to a small group of Asiatic species, distinguished from other representatives of *Canis* by the loss of the last molar tooth on each side of the lower jaw, so that the total number of teeth is forty instead of forty-two. The group is further distinguished by the shorter muzzle and the slightly convex profile of the face. On account of these and certain other points of difference—more especially the presence of either twelve or fourteen teats, instead of the usual ten—these species are frequently referred to a distinct genus, under the name of *Cyon*. Another distinctive feature of these animals is the presence of long hairs between the pads of the feet. The whole of these dogs are in the habit of hunting in large packs, and are noticeable on account of their courage and handsome appearance; the tail being bushy and equal in length to about half the head and body. Since there is no doubt that they are not the ancestral stock of any of the domestic dogs, the name "wild dog" is to a certain degree a misnomer.

This species is an inhabitant of Northern Asia, extending from the
Siberian Wild Dog country from which it derives its name, at least as far southward as the Altai mountains, and probably still further. It may be distinguished from the following species by the circumstance that its molar teeth, especially those of the upper jaw, are of larger size. Like its southern cousin, the Siberian wild dog is subject to seasonal and individual variations in the color of its fur. In summer it seems to be generally of a foxy-red color, becoming darker on the back and lighter on the under parts and the inner surfaces of the limbs. There are, however, two skins in the British Museum characterized by their long and

woolly hair, of which the color in one is white, and in the other a yellowish white ; and these may be presumed to indicate the winter dress.

According to Rade, the Siberian wild dog is a forest-loving animal ; generally frequenting mountains like those on the east bank of the Yenesei where forests are abundant, but occasionally appearing on the open steppes. It is locally distributed ; and while in some localities it preys largely upon deer, in others it is in the habit of hunting ibex. In the Altai these dogs go in troops of from ten to fifteen, or more individuals, led by an old male ; and where they hunt deer it is generally hinds or young animals that they select for pursuit. So incessant is their persecution of the



SIBERIAN WILD DOG.
(One-eighth natural size.)

deer that they will sometimes cause them to completely desert certain localities ; this having taken place in the year 1859 in the valley of the Irkut.

Indian Wild Dog The Indian wild dog (*C. deccanensis*) is perhaps the best-known member of the group, and is distinguished from the preceding species by the smaller size of its molar teeth. Like the others, its general build is more jackal-like than wolf-like ; this being especially shown by the comparative shortness of the legs. It agrees with the Siberian species in the length of the fur, and in the presence, at least in Himalayan examples, of a thick and woolly under-fur. The general color of the fur of the upper parts is a rusty red, varying in some

specimens to a rufous, or even a light brownish gray ; the under parts being paler. Generally the end of the tail is black, but its extreme tip may occasionally be whitish. The young are of a uniform sooty-brown color. A specimen measured by Hodgson had a length of thirty-seven and one-half inches, exclusive of the tail ; the latter measuring fourteen and one-half inches with the hair and eight inches without the same. This wild dog is found throughout the forest-clad portions of the Himalayas, from Kashmir to Assam, and in Gilgit, Ladakh, and Eastern Tibet.



INDIAN WILD DOG.
(One-eighth natural size.)

Southward of the Himalayas, it is found in the larger forests of India, although it is unknown in Ceylon. In inhabiting alike the forests of peninsular India and the forest-clad regions of the Himalayas, as well as the treeless districts of Tibet, the Indian wild dog presents an instance precisely analogous to that of the lynx, already noticed. Hodgson, who alludes to the animal by the Himalayan name of buansu, states that although the Indian wild dog is "not deficient in speed or power of leaping, yet his motions all appear to be heavy, owing to the measured uniformity of his pace. He runs in a lolling long canter, is unapt at the double, and upon the

whole is somewhat less agile and speedy than the jackal, and very much less so than the fox. The wild dog preys both by night and day, but chiefly by day. Six, eight, or ten unite to hunt down their victim, maintaining the chase by their powers of smell rather than by the eye. . . . The buansu does not burrow like the wolf or the fox, but reposes and breeds in the recesses and natural cavities of the rocks." After stating that the number in a pack may occasionally be as many as



MALAY WILD DOG.
(One-seventh natural size.)

twenty, Mr. Blanford observes that these wild dogs "live principally upon deer of various kinds and wild pigs in India, and on wild sheep and antelopes in Tibet. Many sambar and spotted deer are killed by them, while occasionally nilgai and Indian antelopes fall victims. Wild dogs avoid the neighborhood of man, and consequently but rarely attack domestic animals; occasionally, however, they kill sheep, goats, and cattle, and Jerdon mentions one instance, and M'Master another,

of their pulling down a tame buffalo. I came across a third case myself in the jungles east of Bawda, and I was curious to see how so large an animal had been destroyed. There were but a few tooth marks about the nose and throat, and some of the pack had evidently attacked the buffalo in front, while others tore it open. This is probably their usual way of killing large animals; they have been seen to snap at the flanks of a number running." It was stated by Hodgson that wild dogs are in the habit of giving tongue while hunting. This is, however, denied both by Hamilton and Blanford; but it is affirmed that these animals are in the habit of howling at night.

There does not appear to be any authenticated instance of the Indian wild dog attacking human beings. In marked contrast to the wolf and the jackal, it is, if not absolutely untamable, exceedingly difficult to render domesticated in any degree; this of itself being a proof that it has nothing to do with the ancestry of domestic dogs. The young in India are born in the winter, although this is probably not the case in the higher Himalayas and Tibet. The number of cubs in a litter is usually from two to four, but six or more have been observed. In the Himalayas, near Simla, a breeding place was discovered where it appeared that several females bred in company.

By many writers the wild dog of the countries to the eastward of the Bay of Bengal is regarded as inseparable from the Indian form.

Malay Wild Dog

Mr. Blanford, however, takes the opposite view, and considers that the Malayan wild dog is entitled to rank as a distinct species (*C. rutilans*). It is smaller and slighter in build, and has slenderer limbs than its Indian relative; while the "brush" is smaller, and the hair of the body is short and harsh, and has no under-fur. There is also stated to be a difference in regard to the relative length of the flesh-tooth of the upper jaw to the two molars by which it is followed. In color this dog is of a deep ferruginous red above, with the individual hairs scarcely lighter at their roots; while the under parts of the body are whitish. Mr. Blanford gives the length of the head and body of a young male as thirty-two and one-half inches, and that of the tail twelve inches. This species is found throughout the Malay Peninsula, and also in the islands of Sumatra and Java, while it has also been reported to occur in Borneo. It is also found in Tenasserim, and has been obtained near Moulmein; but it has yet to be determined whether the wild dog of Upper Burma belongs to this or the preceding species. It may be suggested that in the latter district it will be found that the specimens indicate a more or less complete transition between the two species.

In concluding our notice of the wild dogs of this group, it may be mentioned that remains of extinct species are found in the cavern deposits of France and Germany. These fossil species appear to have been closely allied to the living ones; and afford one more instance of the derivation of the present fauna of the East from the ancient fauna of Western Europe.

THE MANED WOLF (*Canis jubatus*)

With the so-called maned wolf — a name which is in every respect a misnomer, since the creature is neither distinctly maned nor a true wolf — we come to the first

of a group of South American species, which form the remaining representatives of the wolf-like section of the family. The maned wolf which is of about the same size as the common wolf, differs from the rest of these South American species by its superior size, longer legs, and shorter tail. It is placed by Professor Mivart among the true wolves, but its appearance and habits are so different that we are persuaded that its proper place is here.

The aguara-guazu, as this animal is termed in South America, is a long-legged and long-eared species, with a very conspicuous coloration. The body is covered with long and somewhat coarse hairs, which are more lengthened on the back of the neck than elsewhere; the general color being of a bright yellowish red. There is, however, a black patch extending from the nape of the neck toward the shoulders, and black is also present on the under surface of the lower jaw. Moreover, the legs have black "stockings," standing out conspicuously against the general red color of the body; while the under surface of the upper part of the throat, as well as the insides of the ears and the extremity of the tail are white.

The maned wolf inhabits Brazil, Paraguay, and Northern Argentina, but does not extend as far south as the Pampas. It differs from the true wolves in being an entirely solitary animal—never assembling in packs, and also in being harmless to men. Generally found in moist regions, it lies concealed during the day in bushes and thickets, and does not venture forth till evening for its nocturnal wanderings. It preys generally upon the various species of Rodents which are so common in South America, some of which are so swift as to elude the attacks of domestic dogs, although they fall a ready prey to the maned wolf. Its diet is, however, varied by birds, reptiles, insects, and even fruits; while it will sometimes attack deer, and more rarely sheep. Owing to its nocturnal habits the maned wolf is rarely seen in inhabited districts, but it appears that in regions remote from human habitations it is less cautious in its habits and will issue forth during the daytime.

OTHER SOUTH AMERICAN SPECIES (*Canis azaræ*, etc.)

Azara's Dog The comparatively small and fox-like species known as Azara's dog (*C. azaræ*), is the best known of several South American species in regard to the nomenclature of which there has been much confusion. This dog differs from all the species yet noticed by its fox-like appearance, this being especially shown by its long body, short legs, large ears, and long bushy tail. If, however, we were to assume from this that the creature was nearly related to the European fox, we should be in error, since it has a skull agreeing with those of the wolves and jackals, and quite unlike those of the true foxes, which are unknown in South America. This species is found from Brazil to Tierra del Fuego, and also on the western side of the Andes in Chili and elsewhere. It is true, indeed, that there is great variation in the color of specimens from different regions, on which account a number of nominal species have been determined; but these are all regarded by Professor Mivart as local races of one species. It likewise appears that there is a considerable amount of seasonal variation in the color and length of the fur in the same individuals; the hairs being longer and grayer in winter than in summer,

while those on the back tend to blackness, and those on the face to a grayish-brown instead of a yellowish-gray tint during the former season.

In the average form the color of the sides of the body is gray, while the longer hairs of the back are black and white, with black patches on the shoulders, the middle of the body and the rump; the limbs being fulvous externally, and of a pale yellowish tint internally. The under parts of the body and the inner sides of the thighs are whitish. There is also some white on the upper lip, and on the chest, as well as on the inner sides of the ears; the outer sides of the latter being yellowish, with black tips. The tail, like the back, is mottled with black and white through-



AZARA'S DOG.

out the greater part of its length, but the end is black. White specimens have occasionally been observed.

Mr. W. H. Hudson speaks of Azara's dog as being purely fox-like in its habits, and common everywhere in Argentina, where it inhabits the open Pampas. In Paraguay, on the other hand, according to Rengger, it dwells in jungle-clad districts, from which during the night it roams on the one side into the dense forests, and on the other into the open country. Its main food consists of small Mammals and birds, but it will not refuse lizards; and it displays a marked partiality for sugar cane, doing great damage by the number of canes it destroys without eating

them. In hunting, this dog runs with its nose close to the ground, after the manner of a foxhound, but will at times raise its head to the wind. For the greater part of the year Azara's dog is a solitary animal, but during the winter pairs of male and females go together. The young are born in the spring, and generally comprise from three to four in a litter. The lair may be formed either beneath the cover of a thick bush, or in the deserted hole of another animal, such as an armadillo, but it does not appear that the aguarachay (as this species is termed in South America) ever burrows for itself.

Crab-Eating Dog The crab-eating dog (*C. cancrivorus*), is a rather larger species than the last, sometimes attaining a considerable size, and having a relatively shorter muzzle and tail. It inhabits the regions from Guiana and Demerara to La Plata, although said to be unknown on the Pampas. The color is subject to great individual variation, but, according to Mivart, its prevailing tint may be either a uniform light reddish grey, or darker and mottled. It may have a black back and bright red legs, or may be a dull gray, with very little black, or gray with a very black back. The most normal tint seems to be a brownish gray above, with the crown of the head, sides of the body, and outside of the limbs slightly or strongly rufous. There is generally more or less black on the back and the upper surface of the tail, while the end of the tail is always black. The reddish-brown ears have not the black tips of the preceding species. The carasissi, as this dog is called in some parts, is a forest or jungle-dwelling species, feeding not only upon Rodents and birds but likewise upon crustaceans, and thus earning its common English title. It is stated that these animals will collect in packs and run down and kill deer; and they do much damage to poultry in inhabited districts. Although when hunting in the woods they follow their prey by scent, it is stated that when in the open they hunt by sight.

Colpeo The largest and handsomest of the South American fox-like species, is the colpeo (*C. magellanicus*), from Tierra del Fuego and Chili. This is somewhat superior in size to the largest individuals of the preceding species, from which it is distinguished by its longer and more pointed nose, and the great length of the more bushy tail. The coloration is, moreover, generally of a more decidedly reddish hue. Like the other species, there is considerable individual variation both as regards the color and length of the fur. Generally, the sides of the body are brownish gray, while the back is mottled with black, and the limbs are more or less rufous; the cheeks, throat, under surface of the lower jaw, and the under parts being yellowish white. The ears are dark externally; while the bushy tail is of a light reddish gray, except the tip and a patch on the upper surface near the root, which are black. The colpeo, as Darwin remarks, inhabits alike the moist forests of Tierra del Fuego and the arid deserts of Northern Chili. It is very destructive to poultry; and, though to a large extent nocturnal, may frequently be seen during the daytime.

Short-Eared Dog Our knowledge of the very remarkable species known as the short-eared dog (*C. microtis*) is limited to a single specimen, formerly exhibited in the London Zoological Society's Gardens, and believed to have come from the valley of the Amazon. This animal was about the size of

medium individuals of the crab-eating dog, measuring forty-two inches in total length, of which twelve are occupied by the tail, and standing about fourteen inches at the shoulder. It differs from the other members of the family, except the next, by its short and rounded ears, which communicate to the face a physiognomy quite different from that of all other wild dogs. It is further noticeable for its coloration, the fur being short and thick and generally of a dark iron-gray hue, the individual hairs being black at the tips and white near their roots. The limbs and bushy tail are



THE RACCOON-DOG.
(One-sixth natural size.)

nearly black, but the latter has a curious white patch on the under surface near the root. The ears and snout are rufous.

THE RACCOON-DOG (*Canis procyonoides*)

This curiously-colored and short-eared species is an undoubted dog, and comes nearest to the South American forms described above. It receives its title from a supposed resemblance to a raccoon, but it must be confessed that it requires a considerable amount of imagination to see the likeness. The raccoon-dog inhabits Japan, China, and Amurland, and is characterized by the sharp and pointed muzzle,





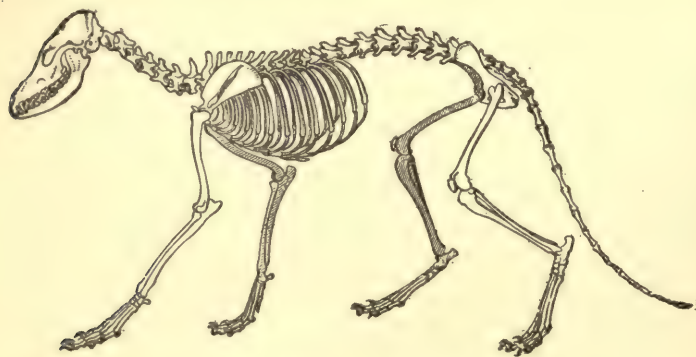
COMMON FOX.

the short rounded ears, the rather short and busy tail, and the great length of its fur, more especially during the winter. There is much individual variation in color, the prevailing tints being dusky yellow and black, but the proportions in which the two occur differing greatly. Black is, however, always present on the cheeks and around the eyes, extending forward to the muzzle, where there is a white spot below the nose on each side. The sides of the head are yellowish, and the forehead may be either of the same color or blackish. The ears have brown margins but are white internally, and sometimes partially so externally. The chin and front of the neck are brown, but, as in the specimen on the right side of our illustration, a yellowish color may extend backward toward the shoulders. The whole of the back has fur varying from a mixture of black and yellow to nearly black, the individual hairs always having long black tips. On the sides the ends of the hair are yellowish; and the chest and under parts vary from brown to nearly black, while the limbs are blackish brown. The tail, on which the hairs are long and pendent, is frequently black above and at its extremity, while below it may be light yellow. The raccoon-dog is chiefly a nocturnal animal, dwelling in summer in the wood-clad mountains, and in winter descending to the neighborhood of the river valleys, where it is said, when in good condition, to hibernate. In Amurland, where it does not hibernate, it feeds largely on fish during the winter, reposing during the day in the thick sedges of the river banks. The asserted hibernation of this animal is a remarkable feature, since no other member of the family takes a winter sleep. The hibernation is said to take place in the deserted burrow of a fox, or some other animal; but it can also construct an earth of its own. The individuals which do not hibernate may be seen in winter crossing the icebound rivers in a succession of short jumps. The raccoon-dog is far from wary, and, as it is almost omnivorous in its food, is easily killed by means of strychnine. The fish which forms its favorite diet in winter is a kind of carp, while in summer the chief food consists of mice, which are pursued either in small companies or family parties. Fruit also forms a portion of its diet. It does little or no damage to poultry; and in Japan has been known to make its winter lair beneath the walls of a house. Both its fur and its flesh are held in high estimation by the Japanese.

THE FOXES (*Canis vulpes*, etc.)

One of the characteristics by which the skulls of the wolves and the other members of the Dog family described above may be distinguished from those of the foxes has been mentioned on p. 500. To this it may be added that the frontal bones of the skulls of the former group are inflated by internal air chambers, which are wanting in those of the latter. Moreover, the pupil of the eye, when contracted, is circular in the wolves, jackals, and domestic dogs, whereas in the foxes it is elliptical. Some of the fox-like South American species of the former resemble, however, foxes in this respect, as they do in external form to a more or less marked degree. On account of these intermediate forms, we cannot agree with those who refer the foxes to a distinct genus, although they differ from all other members of the family in having

but six teats. Foxes are characterized by their slight build, their long, bushy tails, which are nearly always considerably more than half the length of the head and body, and short limbs; while they generally have large ears. All the members of the group are chiefly nocturnal in their habits, hiding in holes or burrows made by themselves, or in ravines, or amongst grass or bushes during the day. They are, as a rule, solitary, and rarely if ever associate in numbers as other *Canidae* do. All the



SKELETON OF FOX.

species are more or less insectivorous and frugivorous; but the more tropical forms appear to live on insects more than do those which inhabit temperate climates. All are highly intelligent and famous for cunning. The group is distributed over North America, Asia,

Europe, and Africa, but is unknown in South America. The smaller African species are distinguished by the inordinate length of their ears.

Common Fox Probably every Englishman thinks he knows the common fox sufficiently well to run no risk of confounding it with any other animal; and if our observations were confined to the ordinary foxes of Europe we should have no great difficulty in deciding that they might be included under one name, although even among these there is a considerable amount of variation in size and color. When we take into consideration the larger foxes of North America and India, we find a number of forms which, while approximating more or less to the British animal, yet differ so remarkably in coloration that it is at first sight hard to believe that they all belong to the same species; but the researches of zoologists have shown that all these various modifications pass more or less completely into the coloration of the typical European fox, and must be regarded as mere local varieties of that widely-spread species.

Including, then, all these varieties under one title, the common fox has a more extensive distribution than any other member of the entire family; its range embracing the whole of Europe and Asia, north of and including the Himalayas, from Iceland to Japan; and also comprising North America from Hudson's Bay and Labrador to the latitude of Northern Mexico, and Africa north of the Sahara and Sudan. The size of the fox, according to Mivart, is subject to such an amount of variation — that if the length of the head and body of a specimen at one end of the series be represented by 100, that of the one at the other will be equivalent to 170. The length of the tail and ears is, however, much less variable.

The ordinary English fox, as represented in our colored plate, is of a reddish-brown color above, and white beneath, while the outer surfaces of the ears, and

portions of those of the limbs are black, and the extreme tip of the tail is white. Occasionally, however, the tip of the tail may be dark gray, or even black, while in one specimen caught in Warwickshire, the whole of the under parts were grayish black. The total length of the head and body may vary from twenty-seven to forty-six inches, and that of the tail from twelve to fifteen inches.

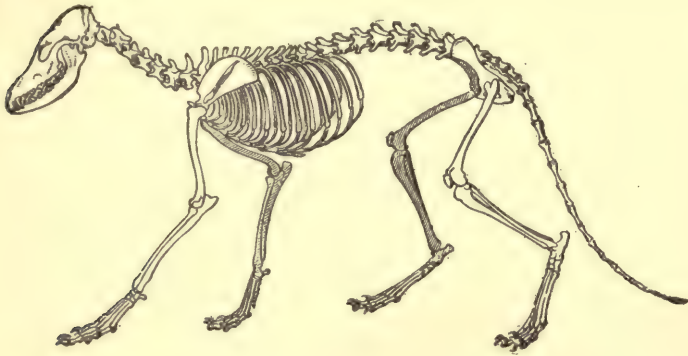
In Southern Europe, black-bellied foxes are far from uncommon, and connect the ordinary form with the Himalayan variety, which has a somewhat similar coloration, and is altogether a paler animal than the English fox. In its long winter dress, the Himalayan fox (which is generally smaller than the English), is a strikingly handsome animal, with the fur of the back varying from chestnut or dull rufous, more or less speckled with yellow, to a dark iron gray. Frequently there is



ARCTIC FOXES ON THE ICE.

a dark stripe across the shoulder, bordered with buff patches in front and behind; while the hinder parts of the back and thighs are grayer and more speckled with white, the sides paler, and the under parts varying from cream color to nearly black. The throat and chest, with the exception of a white spot in the centre of the latter, are frequently darker than the under parts of the body, in which the dusky area may be confined to a streak along the middle. Like the English fox, the outer sides of the ears are black, and the tip of the tail is white; but the limbs have little or no black, and the general color of the tail is grayish, with a more or less marked rufous tinge. The face is rufous, with a black spot below the eyes; while the cheeks are whitish. Very different is, however, the appearance of the animal in summer, after the loss of its long winter coat, when the dark under-fur communicates a grayish-brown tinge to the back, while the sides are paler and the under

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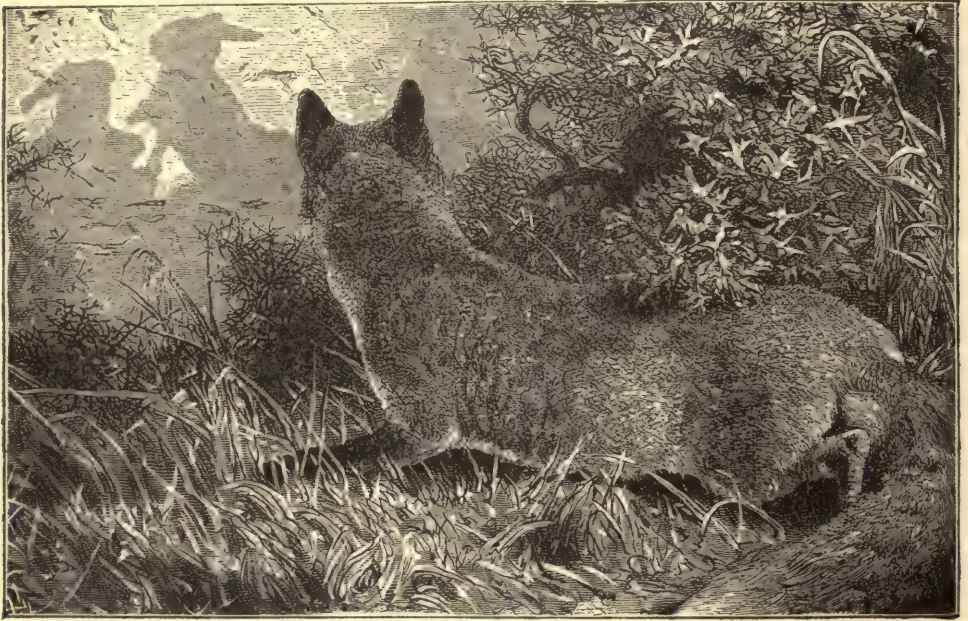
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parts nearly white. The variety is found in the Western Himalayas, from Nipal and Kashmir to Gilgit. In the higher Himalayas, Tibet and probably Afghanistan, it is, however, replaced by another and larger variety which extends over the greater part of Central Asia. This large Central Asian fox is a paler-colored and yellower animal as a rule, with very thick fur, and a superb brush. The Japanese fox is somewhat variable in color, but has been declared to present no points of specific distinction; and the same holds good for the foxes of Siberia and China. The North African fox, which has also been considered a distinct species, must likewise be regarded merely as a variety.



AN INTERESTING DISCOVERY.

American Varieties

This disposes of the foxes of this group found in the Old World, and we turn to those of North America, where there is a greater range of variation in color and markings. These American foxes have received distinct names, according to their coloration. Among these, the so-called red fox is usually of a reddish-yellow color, with the hinder part of the back grizzled, the throat, and more or less of the under parts white, the outer surfaces of the ears black, and the tail, except as the white tip, with black extremities to the hairs. The cross fox, as its name implies, is characterized by the presence of a transverse dark stripe across the shoulders, and of another running down the middle of the back. The tail is darker than in the red fox, while the legs, muzzle, and under parts, are nearly or completely black. The beautiful silver, or black fox, of which the fur is so highly valued, is usually nearly or entirely black, with the exception of the tip of the tail, which is generally white. It derives its name from the gray rings usually marking the otherwise black hairs of the hinder half of the back, the head,

and the thighs, which communicate the peculiar silvery lustre to the fur. Individuals may, however, be met with, in which the fur is either completely black or completely gray. That the red fox and the cross fox are undoubtedly a single species is conclusively proved by a statement of Audubon to the effect that both varieties may be found in a single litter of cubs. While the red and cross varieties are characteristic of the eastern districts of the United States, the far rarer silver fox is a northern form, a large number of its skins coming from the upper reaches of the Mississippi, and the districts to the northwest of the Missouri river.

Habits

So much has been written about the habits of the English fox that our remarks on this subject will be brief. Although the fox is by no means averse to taking possession of the deserted burrow of a rabbit or a badger, it generally excavates its own "earth," in which it spends a considerable portion of its time. As all hunters know, foxes, however, frequently prefer to live out in the woods, those with a northern aspect being, it is said, generally avoided. Sometimes these animals will prefer a thick hedgerow, or a dry ditch, while we have known them to select the tall tussocks of coarse grass in swampy meadows as a resting place; and they have also been found in straw-ricks, where it is on record that in one instance the cubs have been born. The breeding time is in April, and the usual number of young in a litter is from four to six. The prey of the fox consists, writes Bell, "of hares, rabbits, various kinds of ground birds, particularly partridges, of which it destroys great numbers; and it often makes its way into the farmyard, committing sad havoc among the poultry. It has been known not unfrequently to carry off a young lamb. When other food fails the fox will, however, have recourse to rats and mice, and even frogs and worms; while on occasion beetles are largely consumed, and, on the seashore, fish, crabs, and mollusks form a part of its diet. Carrion seems never to come amiss; while the old story of the fox and the grapes alludes to the fruit-eating propensities of these animals." The usual cry of the fox is a yelping bark. The well-known scent of the fox is secreted by a gland situated beneath the tail. The cunning displayed by English foxes in escaping from hounds has been so often described, that we shall make no further allusion to it here, beyond saying that it has probably attained its present development as the result of the inherited experience of many generations.

That the fox is an ancient inhabitant of the British Islands is proved by the occurrence of its fossilized remains in caverns in company with those of the mammoth and other extinct animals. This, however, is not all, for a skull, indistinguishable from that of a large English fox, has been dug up from the sands lying at the top of the Red Cray of Suffolk, which are vastly older than the mammoth period.

Gray Fox

A very different animal from the red American variety of the common fox is the gray fox (*C. virginianus*) of North America, which is regarded by Professor Mivart as exhibiting some approximation to the fox-like South American species described above. It is a considerably smaller animal than the average European fox; and is characterized by the grizzled gray color of the top of the head and the upper part of the body; in marked contrast to which is the rufous tint of the fur of the sides of the throat and body and the limbs. The upper surface of the tail is dusky, while below it is chestnut; its extremity being dark,

and there being also a dark patch near its root, connected with a dark mark running along the back. The chin is black, as is a spot on each side between the nose and the eye; the outer surfaces of the ears are rusty red; the middle of the throat is nearly or quite white; while the under parts of the body are yellowish white. The gray or, as it is often called, the Virginian fox, is found from the United States to Central America.

Dr. Ellzey, when contrasting the habits of the gray fox with the red American variety of the common species, observes that the two animals differ very widely in these respects. "So far as my personal observations inform me," he says, "the following are some of the principal distinctions. First, as to reproduction: the red fox nearly always brings forth its young in an earth den, the gray fox generally in a



THE GRAY FOX.
(One-eighth natural size.)

hollow log or tree, or, at most, under a rock. The last one I found with her young was a gray. The young, only a few hours old, were in the hollow stump of an old rotten tree, broken off about five feet high. As I came up, the old one jumped out of the top of the stump, and ran off. I looked down the hole, and saw at the bottom five young ones, scarcely dry. I have seldom seen a gray with more than five, and often with only four young. I never found a red with less than five. I have seen one with nine, and several with seven. I think it certain, therefore, that the reds are more prolific. Second, as to hunting for prey and subsistence: the reds are bolder in pursuit, and hunt over a much greater territory than the grays. Whether the grays ever climb trees in pursuit of prey I am uncertain, but they take to a tree as readily as a cat when run hard by hounds. I think it is nearly certain that they climb for persimmons and grapes. Red foxes never climb trees under any

circumstances; when hard run they go to earth. Gray foxes run before hounds only a short distance, doubling constantly and for a short time, when they either hole in a tree or climb one. I have known the red fox to run straight away nearly twenty miles. Very commonly they run eight or ten miles away, and then run back in a parallel course. I have known them to run the four sides of a quadrilateral, nine or ten miles long by about two miles broad. It is doubtful whether a first-rate specimen of the red fox, taken at his best in point of condition, can either be killed or run to earth by any pack of hounds living, such are his matchless speed and endurance. It is but a sorry pack which fails to kill or tree a gray fox in an hour's run. The young of the gray fox closely resemble small blackish puppies; those of the red fox are distinctly vulpine in physiognomy when only a few hours old."

Kit Fox The smallest and prettiest of the North American species is the kit fox (*C. velox*), which derives its Latin name from its extraordinary fleetness. In this fox the length of the head and body is only twenty-four inches, and that of the tail, without the hair, nine inches. The animal is characterized by the shortness and stoutness of its limbs, standing relatively lower than the common fox, and also by the bushy tail being less than half the length of the body. The thickly-furred ears are also relatively shorter than in the common fox. Another distinctive characteristic is the length and abundance of the under-fur, which is often visible externally and also by the long hairs clothing the soles of the feet. In color the kit fox is somewhat variable, but a specimen described and figured by Professor Mivart has the back and tail dark gray, mingled with black and white hairs, the tip of the tail black, the cheeks, shoulders, flanks, and the outer surfaces of the limbs rufous, and the under parts white. The kit fox is confined to Northwestern America, where it inhabits open treeless districts, constructing its own burrows in the ground. It was formerly abundant on the plains of Columbia, and also in those lying between the Saskatchewan and the Missouri rivers, but it has of late years considerably decreased in numbers.

Arctic Fox Widely different from all other species is the Arctic fox (*C. Lagopus*) characterized by the difference between its summer and winter dress, as well as by certain peculiarities in its form and habits. This species, which appears to inhabit nearly the whole of the known Arctic lands, descending in America to latitude 50°, and in the Old World to 60°, has a less pointed muzzle, and much shorter and more rounded ears than any other fox, while the hinder parts of the cheeks are bordered with a kind of ruff of long hairs, and the soles of the feet are covered with a thick coat of woolly hair, which is most developed in winter. In the summer dress the hair is of moderate length, and is frequently of a brown or dull rufous color on the head, back, outer sides of the limbs and tail; the under parts being yellowish white. The under-fur is bluish gray, and the roots of the long hairs are also of the same tint; and when this bluish gray extends farther up the hairs than usual the general color of the fur is of the same hue. In other cases, as in the accompanying illustration, the whole of the upper parts and the outer sides of the limbs are bluish gray, while the flanks and under parts are almost white.

With the assumption of the winter dress the fur becomes longer and thicker, and the white hairs which are scattered through the summer coat gradually

increase in number, at the same time as the tips of the other hairs become white, until the whole length of each hair is of that color. The animal is then completely clad in white, the naked tip of the nose being, however, black, while in certain cases the extremity of the tail may also be black. A specimen in the pure white winter dress is represented in the foreground of our second illustration. This winter change of color is, however, by no means of constant occurrence; gray hairs sometimes largely mingling with the white, while at other times the prevalent hue of the fur is a uniform bluish gray, as shown in the upper figure of our second illustration. Moreover, occasionally, pure white foxes are to be met with in summer. In Iceland, where the winter is less severe than in the more northerly regions, the winter



ARCTIC FOX IN SUMMER DRESS.
(One-eighth natural size.)

dress of the Arctic fox is nearly similar to the summer one, so that these animals are "blue" at all seasons.

The assumption of a white dress in winter is in order to assimilate the color of the animal to that of the snow-fields among which it dwells, and it is somewhat difficult to understand why the change does not invariably take place in the more northern regions. The hair clothing the soles of the feet is to aid the creature in obtaining a sure foothold on frozen snow and ice.

According to Richardson, Arctic foxes, which were formerly abundant on the shores of Hudson's Bay, dwelt there in small colonies of from twenty to thirty burrows each. During the autumn and winter such of these foxes as inhabit the more northern districts of Arctic America undertake a southerly migration, keeping as much as possible to the coasts, and the length of the migration depending to a considerable extent whether the line of the coast coincides with the line of march.

The Arctic fox preys largely upon birds, especially upon various members of the auk family, as we learn from Professor A. Newton, who writes, that "the Arctic fox is pretty numerous along the shores of the Ice Sound [Spitzbergen]; and we not only frequently saw examples of it, but in the immediate neighborhood of the cliffs wherein the *Alcidæ* were nesting one could, by listening almost at any time in the twenty-four hours, hear its yapping bark. It is of course the chief enemy of all the different kinds of birds, and their dread of it appears to influence them greatly in their choice of breeding quarters. What the foxes do to get a living in winter,



ARCTIC FOX IN WINTER DRESS.
(One-eighth natural size.)

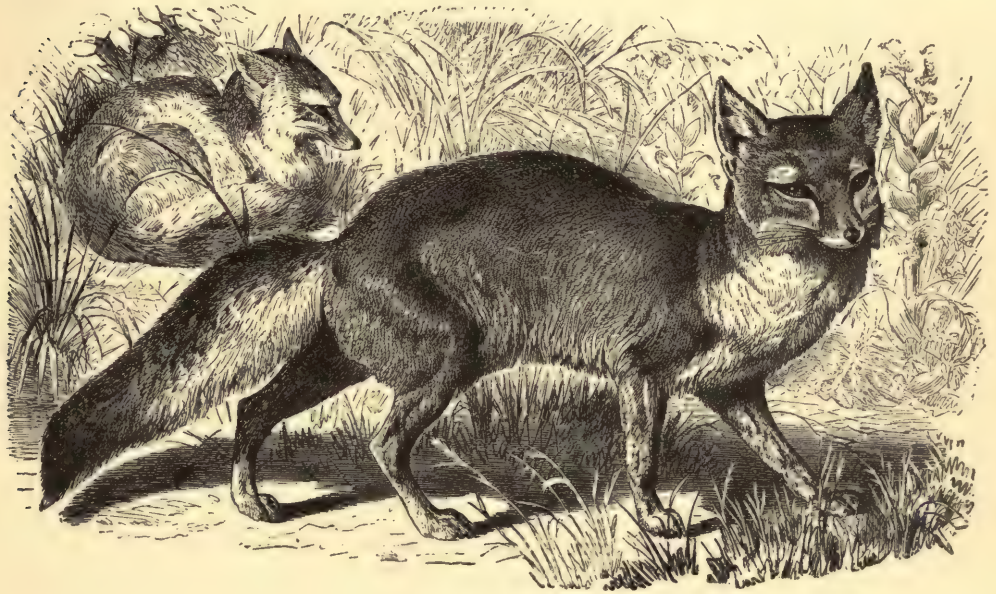
when the birds have left the country, is one of the most curious questions that has presented itself to my mind for some time. The greater number of them are said to remain on the land and to be as active during the long polar night as they are in summer; yet there are no berries by which they might eke out their existence, and there can be no open water, on the margin of which they might find food within miles of their haunts. The most natural explanation that occurs to one is that they lay up a stock of provisions; but nobody, that I am aware of, has ever found such a store-closet." Not only does this fox prey upon the Arctic birds themselves, but it also robs their eggs. Dr. Packard, when describing his experiences in Northern

Labrador, writes that on a certain day "I started up a blue fox, which was running toward me with a murre's [guillemot's] egg in his mouth; on my throwing a stone at him he dropped the egg and scampered off. I hallooed for nearly ten minutes for some one with a gun to come and shoot him, and kept him in sight. With more of curiosity than fear he would stop at intervals to look at me, keeping a safe distance off and barking, until he disappeared. Soon Mr. W. came up; we pursued, finding him on the other side of the island, with another egg in his mouth. Mr. W. gave him his death wound, though he ran some distance with the egg between his teeth before he dropped dead. His flanks and belly were white, the rest of a slate-blue color, his legs very long, and tail long though not very bushy. The more remarkable features were his short, rounded ears, as if cropped." It is not, however, by any means solely on birds and their eggs that the Arctic fox subsists, as in some districts it also preys largely upon the small Rodents known as lemmings. In one district during the Arctic Expedition of 1875, under Sir G. S. Nares, numbers of dead lemmings were discovered which had been killed by these foxes, and hordes of lemmings were pulled out from the crannies of the rocks, which had been collected by the foxes as a winter provision; thus confirming Professor Newton's suggestion as to the probable manner in which these animals subsist in winter.

Desert Fox With the desert fox (*C. leucopus*) of Southwestern Asia we revert to the foxes of the temperate and tropical regions of the Old World. This species is considerably smaller than the common fox, the length of the head and body varying from nineteen to twenty-two inches, and that of the tail from twelve to sixteen inches. It agrees, however, with that species in having a small white tip to the tail, as it also does in the dark-colored ears. Moreover, when the full tints are developed, this animal is more strikingly colored than the common species, although there is a considerable amount of individual variation in this respect. When fully colored, the fur of the back varies from brownish yellow to rusty red, and there is usually a distinct pale patch on each side of the back behind the shoulders, in front of which is a dark transverse stripe across them. The sides are lighter, while the under parts generally vary from slaty gray to blackish, the chin, and generally a spot on the chest, being white. In summer the dark under-fur is seen through the ordinary hairs, and the whole color is grayer, the under parts being then nearly white. This species is found throughout most of the sandy and more or less desert regions on the western side of India, and also extends into Baluchistan, Afghanistan, probably Persia, Arabia, and most likely other districts of Southwestern Asia. It is essentially a desert-hunting species, and in India appears to live chiefly on the gerbils so common in the same sandy regions.

Corsac Fox In the deserts of Central Asia the preceding species is replaced by the corsac fox (*C. corsac*), distinguished by its general paler color, white under parts, and the black tip to the tail, the shoulder spots and stripe of the desert fox being also wanting. The two are, however, evidently very closely allied and Professor Mivart suggests that they may prove to be local varieties of one species. The range of the corsac extends from the banks of the Volga and the shores of the Caspian Sea to the southeastern parts of Siberia; while eastward it

is doubtless continued into China, although its limits in this direction, as well as to the northward, are unknown. It has been obtained from Amurland. Like the desert fox, the corsac is entirely restricted to open and more or less desert regions. It preys largely on small Rodents, such as voles, picas, and the like, and is chiefly nocturnal. It does not appear that it makes a burrow for itself, generally tenanting the deserted hole of a marmot, which it leaves after a time for that of another. The corsac is soon run down by dogs, and when tracked to its lair through the snow in winter is said to remain below, and rather than bolt perish from hunger.



THE CORSAC FOX.
(One-seventh natural size.)

The little-known Tibetan fox (*C. ferrilatus*), from the neighborhood of Lhasa, is another nearly-allied small species, distinguished by the relatively shorter ears being pale rufous instead of dark colored; the tip of the tail being white.

Indian Fox The pretty little Indian fox (*C. bengalensis*), which, with the exception of an allied species, is the smallest of the true foxes, and is familiar to all who have resided in India, being often seen in the early morning close to the fort at Calcutta. The Indian fox, known like the other species in its native country by the name of lumri, measures only twenty inches from the tip of the snout to the root of the tail, while the length of the tail varies from thirteen to fourteen inches. The tail is thus shorter in proportion to the head and body than in the common fox, and the limbs are characterized by their slenderness. Although subject to the usual variation characteristic of the foxes, the general color of the fur of this species is gray, with a more or less marked reddish tinge, there being no cross band on the shoulders, and the tip of the tail black, while the ears are gray. This

black tip to the tail, coupled with the small size of the animal, at once distinguishes this species from all the other foxes inhabiting India proper.

This fox is to be met with everywhere in India, except where there are thick forests; but it does not occur to the westward of the Punjab nor to the eastward of Assam, while its reported occurrence in Ceylon is more than doubtful. Its cry is a short yelping bark, quickly repeated three or four times. It is by no means shy, and I have shot one which had walked boldly up to within gunshot range of my camp. Sir W. Elliot writes that "its principal food is rats, land crabs, grasshoppers, beetles, etc. On one occasion a half-devoured mango was found in the stomach. It always burrows in the open plains, runs with great speed, doubling like a hare; but instead of striking out at first like that animal, and trusting to its turns as a last resource, the fox turns more at first, and if it can fatigue the dogs then goes straight away." Jerdon states that "the burrow which this fox makes has always several openings converging toward the centre, some of them blind, others leading toward a larger central one where the animal breeds. This is often two or three feet below the surface. The burrow is usually situated quite in the open plain, now and then in some thorny scrub. In alluvial plains the fox takes advantage of any small rise in the ground to prevent its den being flooded in the rains, and its burrow is frequently found in the dams of tanks and other artificial mounds. I have on two occasions run foxes to holes in old trees, which, from the marks round one of them, had evidently been occupied by the animal for long. Lizards are a favorite food with the fox, as well as rats, crabs, various insects, white ants, etc."

On account of not possessing the strong scent of its European relative, the Indian fox is but little hunted with hounds. It is, however, frequently coursed with greyhounds, when, from its numerous doubles, it gives a good run; pure-bred English greyhounds, are, however, too fleet to give good sport, and either half-bred or Arabian or Persian dogs are in consequence generally employed. According to Jerdon, when the animal is going slowly or hunting for food, the tail is trailed on the ground; when running, it is stretched out horizontally; while during the doubling it is raised erect. The young are almost invariably four in number at a birth, and are produced during February, March, and April. The Indian fox is easily tamed, and in this state is more agreeable than most other foxes, owing to the absence of odor.

Hoary Fox This fox (*C. canus*) is a still smaller species inhabiting Baluchistan and the southern parts of Afghanistan, and at present known in Europe by only three specimens. The length of the head and body is only eighteen inches, and that of the unusually long tail from fifteen to sixteen inches. It is distinguished from the preceding species by the more ashy-gray tinge of its fur.

LONG-EARED FOXES (*Canis chama*, *zerda*, etc.)

The South African asse fox (*C. chama*) is the first of a group of four species from Africa, two of these being characterized by the extreme length of their ears. It is somewhat smaller than the common fox, but it has considerably longer ears, and therefore appears to form a kind of transition from the true foxes toward the



AFRICAN FENNECS.

fennecs. It is a yellowish-colored animal, with some black hairs mingled with the light fur of the back, a black tip to the tail, and some chestnut splashes on the snout. It inhabits both sides of the Orange river in great and little Namaqualand, and extends eastward to Kimberley.

Pale Fox This fox (*C. pallidus*) may be distinguished at a glance from the preceding, not only by its much smaller size, but likewise by its longer ears and the thinness of the tail. The general color is a pale yellow, with a faint tinge of red; the tail having many black hairs among the lighter fur, a small dark spot on the upper surface near the root, and a small black tip. In its smaller size and longer ears, this species approaches still closer to the fennecs. It comes from East and West Africa, having been obtained from Senegambia and Nubia and Kordofan.

Rüppell's Fennec Rüppell's fennec (*C. famelicus*) is distinguished from all the species hitherto noticed by the great length of its ears, although these are proportionately smaller than in the true fennec. It is a smaller animal than the pale fox, the length of the head and body being about nineteen inches, and that of the tail nine and one-half inches; while the ears measure just over three inches in length. This fox has a fawn-colored head, reddish back, shoulders, and tail, grayish sides, and nearly white under parts; but as it can be so easily recognized by its ears, it is unnecessary to devote further attention to its coloring. Rüppell's fennec was originally obtained from the Nubian deserts, but either this or a closely-allied species occurs in Syria and parts of Persia, as well as in Afghanistan.

Common Fennec The last and smallest representative of the genus *Canis* is the pretty little North African fennec (*C. zerda*), in which the total length of the head and body is only just over fifteen and one-half inches, the tail measuring six and three-fourths inches, and the ears being at least three inches in length, and sometimes even more. The ears, being wide in proportion to their length, are of enormous size compared to the head, and thus communicate a remarkable physiognomy to the animal. The general color of the fur of the upper parts of the fennec varies from a pale fawn to buff, the under parts being white, and the tip of the tail black; while there may be black markings on the upper part of the latter near its root. On the forehead and round the eyes the fur is nearly white; while the outer surfaces of the ears are rufous, and their inner margins have some long and nearly white hairs. Sometimes there is a black mark in the middle of the hinder part of the back.

The fennec is confined to Northern Africa, ranging from Nubia to Algiers, and occurring over the whole of the Sahara desert. It is essentially a desert animal, with the sands of which its pale coloration is in complete harmony; and it is likewise mainly nocturnal in its habits. Like the common fox, the fennec makes a burrow, which is generally situated in the neighborhood of the tufts of low plants growing here and there in the desert; these plants rendering the soil more coherent, and therefore easier to burrow in. The inside of the burrow is lined with feathers, hair, and soft vegetable substances, and is remarkable for its cleanliness. The burrows are made with wonderful rapidity — so quickly, indeed, that the animal seems

to sink into the ground as though it were diving into water ; and when hunted the creature generally manages to escape by thus burrowing. During the day the fennec reposes in its burrow, with its head curled up beneath the bushy tail, and only the ears exposed. At the slightest sound or movement it is, however, on the alert ; and, when thus disturbed, it utters a slight whimper, and soon endeavors to dispose itself again to slumber. At sunset the fennec leaves its burrow and makes for its drinking place, but instead of going straight across the sand dunes, it always seeks the protection of such ravines and hollows as there may be. Around the drinking places the moist earth is covered with countless impressions of its feet. After having satisfied its thirst, the fennec sets about seeking its food, which may be either jerboas, small birds, lizards, insects, or fruit.

The burrows are generally made near together, so that the fennecs live in small colonies or companies. According to native reports, the young are born in March, the number in a litter being either three or four.

THE CAPE HUNTING-DOG (*Lycaon pictus*)

With the fennec we took leave of the last member of the family which can be included in the typical genus *Canis*, and we now come to the first of three species which represent as many distinct genera. The curious-looking animal depicted in the illustration on the next page, and commonly known as the Cape hunting-dog, differs from other members of the family in having but four toes to each foot, and also in its peculiar irregularly-spotted coloration. The number of the teeth is the same as in the wolf ; and the skull has also a considerable resemblance to that of the latter, although shorter and broader ; while the form of the cheek-teeth is likewise rather different. In point of size the hunting-dog may be compared with a tall greyhound. Its limbs are relatively long ; the head is broad and flat with a somewhat short muzzle, and rather large ears. The fur is rather thin, and is colored with a mixture of black, yellowish ochre, gray and white, the disposition of the colors varying greatly in different individuals, and the patches or blotches being generally arranged unsymmetrically on the two sides of the body. Professor Mivart describes the usual coloration as follows : "The general ground color is an ochraceous gray, but with black markings, so that the body and outer sides of the extremities are blotched and brindled with black, intermingled here and there with white spots edged with black ; the markings being very irregular. The muzzle is black, and a black stripe sometimes, but not always, passes backward from between the eyes and ears, and along the neck. The root of the tail is ochraceous, then more or less black, with the terminal portion white or whitish ; it is rather bushy. The ears are said to be more or less naked ; they are more or less black within, though with some white hairs, while externally they are of an ochre color at their roots, above which they may or may not be black." In some specimens, the front of the fore-limbs is more or less marked with black. In the specimen here represented, the coloration is very irregular, there being a large amount of white on the under surface. In others, however, the ochre color is predominant, and the black consists mainly of

irregular spots, while there is scarcely any white. This animal inhabits nearly the whole of Africa to the southward and eastward of the Sahara.

The most remarkable feature about the hunting-dog is its superficial resemblance to the spotted hyæna of the same country ; this being most noticeable in those individuals in which the ochre color predominates, and the dark areas take the form of spots. From this resemblance, which is merely superficial and indicates no sort of affinity between the two animals, the hunting-dog is frequently termed the hyæna-dog. To account satisfactorily for this resemblance is very difficult. It has been



CAPE HUNTING-DOG.
(One-tenth natural size.)

suggested that it is a case of "mimicry" ; that is to say, the resemblance to the hyæna is due to some advantage which the hunting-dog thereby gains. It is, however, very difficult to see what advantage a strong animal hunting in packs, like the present species, can gain by being mistaken for a hyæna, as it is in every respect fully qualified to take care of itself. If, however, we could suppose that the hunting-dog was originally a solitary animal, which had subsequently become gregarious, then perhaps the resemblance to the hyæna might have been an advantage to it.

Although generally nocturnal, the hunting-dog may occasionally be seen during the day. One of the best accounts of its habits is given by Gordon Cumming, who writes as follows: "The wild dogs, or *vilde honden*, as they are called by the Dutch boers, are still [about 1845] abundant in the precincts of the Cape Colony, and are met with in great numbers throughout the interior. These animals invariably hunt together in large organized packs, varying in number from ten to sixty, and by their extraordinary powers of endurance, and mode of mutual assistance, they are enabled to run into the swiftest or overcome the largest and most powerful antelope. I have never heard of them attacking the buffalo, and I believe that the animal pursued in the present instance [a gnu] is the largest to which they give battle. Their pace is a long never-tiring gallop, and in the chase they relieve one another, the leading hounds falling to the rear when fatigued, when others, who have been husbanding their strength, come up and relieve them. Having succeeded in bringing their quarry to bay, they all surround him, and he is immediately dragged to the ground, and in a few minutes torn to pieces and consumed. They are of a bold and daring disposition, and do not entertain much fear of man, evincing less concern on his approach than any other carnivorous animal with which I am acquainted. On disturbing a pack, they trot leisurely along before the intruder, repeatedly halting and looking back at him. The females bring forth their young in large holes, in desolate open plains. These burrows are connected with one another underground. When a troop of wild dogs frequenting these holes observes a man approaching they do not, as might be supposed, take shelter in the holes, but rather trusting to their speed, they rush forth, even though the intruder should be close upon them, and retreat across the plain, the young ones, unless very weak, accompanying them. The devastation occasioned by them among the flocks of the Dutch boers is inconceivable. It constantly happens that when the careless shepherds leave their charge, in quest of honey or other amusement, a pack of these marauders comes across the defenseless flock. A sanguinary massacre in such cases invariably ensues, and incredible numbers of sheep are killed and wounded. The voracious pack, not content with killing as many as they can eat, follow resolutely on, tearing and mangling all that come within their reach. Their voice consists of three different kinds of cry, each being used on special occasions. One of these cries is a short angry bark, usually uttered when they behold an object which they cannot make out. Another resembles a number of monkeys chattering together, or men conversing together when their teeth are chattering violently from cold. This cry is emitted at night, when large numbers of them are together, and they are excited by any particular occurrence, such as being barked at by domestic dogs. The third cry resembles the second note uttered by the cuckoo which visits our islands during the summer months, and, when heard in a calm morning echoing through the distant woodlands, has a very pleasing effect." From later accounts it would appear that the holes referred to above are inhabited by the hunting-dogs only during the breeding season, and that they are not excavated by the animals themselves.

The numbers in which these dogs were formerly wont to associate together is illustrated by the following anecdote from the writer just quoted. Being suddenly wakened from slumber one night, the great hunter states that "I heard the rushing

of light feet as of a pack of wolves close on every side of me, accompanied by the most unearthly sounds. On raising my head, to my utter horror, I saw on every side nothing but savage wild dogs, chattering and growling. On my right and on my left, and within a few paces of me, stood two lines of these ferocious-looking animals, cocking their ears and stretching their necks to have a look at me; while two large troops, in which there were at least forty of them, kept dashing backward across my view, within a few yards of me, chattering and growling with the most extraordinary volubility. Another troop of wild dogs were fighting over the wildebeest I had shot, which they had begun to devour. On beholding them I expected no other fate than to be instantly torn to pieces and consumed. . . .



HUNTING-DOGS CHASING GEMSBOK.

However, I had presence of mind to consider that the human voice and a determined bearing might overawe them, and accordingly, springing to my feet, I stepped on the little ledge surrounding the hole, while, drawing myself to my full height, I waved my large blanket with both hands, at the same time addressing my savage assembly in a loud and solemn manner. This had the desired effect; the wild dogs removed to a more respectful distance, barking at me something like collies."

Probably a sight like this cannot at the present day be witnessed, although hunting-dogs are still numerous in the Kilima-njaro district. Of scarcely less interest than these large assemblies must, however, be the spectacle of two or more of these animals in full pursuit of an antelope. Such a hunt was witnessed by Mr. Selous in Bechuanaland, the pursued being a male sable antelope, and the pursuer a

single hunting-dog. This hunter and his comrades had been for some time watching the antelope, when suddenly it started off full in their direction. On looking round for the cause of this sudden movement, "we saw," writes Mr. Selous, "that an animal was running on its track, and, although still distant, was overhauling it fast, for the sable antelope, not being pressed, was not yet doing its best, so that when it was about two hundred yards from us, its pursuer, which we now saw was a wild dog, was not more than fifty yards behind us. The noble-looking antelope must just then have seen us, for it halted, looked toward us, and then turning its head glanced at its insignificant pursuer. That glance, however, at the open-mouthed dog thirsting for its life-blood must have called unpleasant reminiscences, for instead of showing fight, as I should have expected it to have done, it threw out its limbs convulsively, and came dashing past us at its utmost speed. It was, however, to no purpose, for the wild dog lying flat to the ground as a greyhound, its bushy tail stretched straight behind it, covered two yards to its one, and came up to it in no time. It just gave the antelope one bite in the flank, and letting go its hold instantly fell a few yards behind; at the bite the sable antelope swerved toward us, and upon receiving a second in exactly the same place, turned still more, so that, taking the point on which we stood as centre, both pursuer and pursued had described about half a circle round us, always within two hundred yards, since the sable antelope had first halted. As the wild dog was just going up the third time it got our wind, and instead of again inflicting a bite stopped dead and looked toward us, whilst about a hundred yards from it the sable antelope also came to a stand. The baffled hound then turned round, and made off one way, while the sable antelope, delivered from its tormentor, cantered off in another." Mr. Selous adds that this is the only instance known to him of a hunting-dog pursuing an animal by itself.

In the form of the last premolar tooth of the lower jaw the skull of the hunting-dog presents a peculiarity by which it can be distinguished from that of the wolves; and it is remarkable that a lower jaw from a cave of Glamorganshire shows the same peculiarity in the tooth in question, thus indicating that during the mammoth age a hunting-dog, nearly allied to the living African species, pursued its prey on the Mendips.

THE BUSH-DOG (*Iticyon venaticus*)

The bush-dog of Brazil and British Guiana is an animal of or about the size of a fox, differing from all the other members of the family in external appearance, although it is not on this ground that it is separated from *Canis*. It is a short-eared, short-legged, and long-bodied animal, with a very deep and rather elongated neck, and of a general dark brown color. The head, neck, and shoulders differ from the general body color in being gray, while the hind-quarters, tail, and under parts are nearly black. The great peculiarity of this animal is, however, the circumstance that it has usually but one molar tooth in the upper jaw, and only two of these teeth in the lower jaw, so that it has fewer teeth than any other member of the Dog family. This, however, is not all, for the lower flesh-tooth has no trace

of the cusp found on the inner side of the blade in all other dogs ; while the heel of the same tooth, instead of being broad and adapted for grinding, is brought to a sharp cutting edge. These features indicate that the bush-dog is a more specialized animal than the other members of the family.

But little is known of the habits of the bush-dog in the wild state, as it is but seldom seen, and is probably nocturnal. We are informed, however, that these animals are, for their size, very fierce, and hunt in packs. They are found only in the interior of the countries they inhabit ; and are said to take readily to the water. A specimen kept in captivity was very indiscriminate in its feeding, but preferred animal



LALANDE'S DOG.
(One-eighth natural size.)

to vegetable substances. Fossil remains of the bush-dog are found in the caverns of Brazil, in company with those of a host of strange animals long since passed away.

LALANDE'S DOG (*Otocyon megalotis*)

As the bush-dog is remarkable for the diminution in the number of its teeth, so the long-eared, or Lalonde's dog, is peculiar in that it has more than the ordinary complement of these organs. Thus, while in the lower jaw this animal has invariably four molar teeth, or one more than in any other member of the family, in the

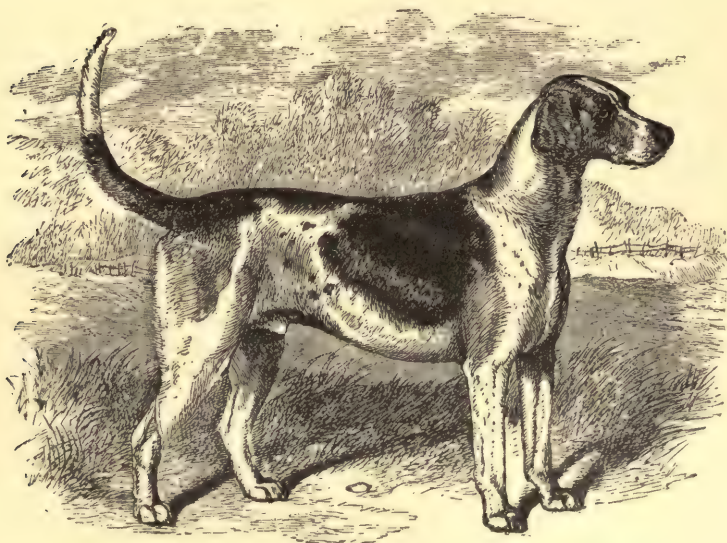
upper jaw it has either three or four of these teeth, whereas in all other living canine animals there are not more than two upper molars. The total number of teeth is accordingly either forty-six or forty-eight; and no other Mammal outside the Marsupial order ever has four molar teeth in both jaws. Indeed, the tenrec is the only one in which there are four of these teeth even in one jaw. Lalande's dog is, therefore, a very interesting animal, and one which retains, perhaps, traces of a Marsupial ancestry lost in other living Mammals, except the tenrec. This species, which is rather smaller than a common fox, comes nearest in external appearance to the fennecs, having enormous ears and a thick, bushy tail. The eyes are unusually large; the limbs are relatively longer than in the fox, but the tail is proportionately shorter. The general color of the fur is brownish or iron gray, mottled with yellow; the outer sides of the limbs being nearly black, the under parts whitish, and the tail slaty gray, with a black tip, and more or less distinct dark markings on its upper surface. These animals are natives of South and East Africa; but very little is known of their habits. They are generally found in open country, dwelling under or among small bushes, and going about in pairs. Although they are said to stand and watch the hunters by the hour together, they are very difficult of approach.

EXTINCT DOGS

It has been mentioned that the fossil remains of several living members of the Dog family have been obtained from the superficial deposits of the countries which they severally inhabit. It has also been mentioned that extinct species of the Asiatic wild dogs and of the African hunting-dog have been found in Europe, thus indicating for those two groups a former distribution of wider extent than at present. A number of extinct species belonging to the genus *Canis* have also been obtained from the Pliocene and upper half of the Miocene deposits of different parts of the world. These, however, are all more or less closely allied to living species, and are accordingly of no very special interest to the evolutionist.

On the other hand, if we go somewhat further back in the geological record, to the lower portion of the Miocene and the upper part of the Eocene period, we come across remains of more or less decidedly dog-like animals widely different from living forms. Some of these extinct creatures are, indeed, to a considerable extent, intermediate between dogs and civets; and thus indicate that the Civet family is probably derived from the ancestors of the Dog family. This enlarges our view of the relationships of the various modern Carnivores to one another, for we have already shown that the hyænas are closely related to the ancestral civets, and the cats are probably another side branch nearly allied to them. We thus have reason to believe that all the Carnivores with bladder-like tympanic bullæ to their skulls—namely, cats, civets, hyænas, and dogs—have sprung from a common ancestral stock nearly allied to the modern dogs. The most civet-like of these intermediate extinct animals are known by the name of *Cynodictis*, and they were mostly creatures of about the size of the fox, with teeth either numerically the same as in the latter, or as in the civet, and with plantigrade feet.

Far more remarkable is, however, the connection which is shown to exist by these fossil types between the dogs and the bears, which are now so widely sundered. The connecting type appears to be a creature known as the *Amphicyon*, of which a lower flesh-tooth is shown on p. 356. Some of these *Amphicyons* were not larger than a fox, while others must have fully equaled a bear in size. They differed from modern dogs in having forty-four teeth, owing to the presence of the third pair of molars in the upper jaw, and also in that their feet were plantigrade, like those of a bear; while they had five toes on all feet. The teeth of these plantigrade dogs, as they may be called, were, indeed, essentially those of a modern dog; but, as we shall show later on, there is a complete transition through other extinct forms to those of the bears. Hence, we conclude that these plantigrade dogs were not only the ancestors of the modern dogs, but likewise gave origin to the Bear family. The Dog family is, therefore, the most ancient type of Carnivores now living, and the one which includes the extinct forms from which nearly all the others have originated.



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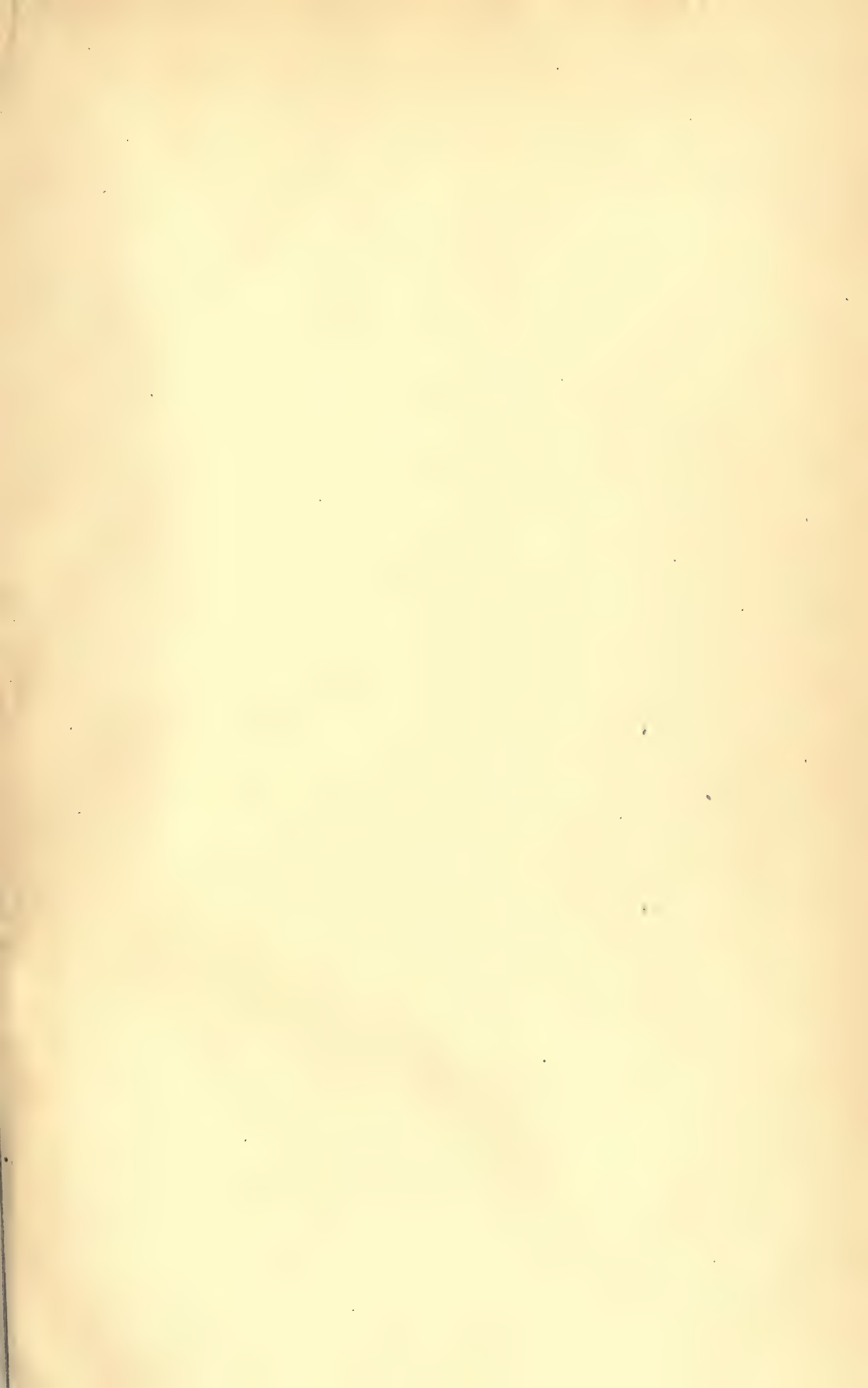
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